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CLASSIFICATION OF THE BANANAS.

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III. Critical Notes on Species*.

i. Musa sanguinea *Hook. f.* Bot. Mag. 98, t. 5975 (1872).

This species of the section *Rhodochlamys* is a native of Assam, collected in the Mahuni Forest by Mann ; but it was described by Hooker from a plant in cultivation at Kew, and is best known in cultivation down to the present. Material in the I.C.T.A. collection was received as seed in 1938 from 's Lands Plantentuin, Buitenzorg, Java. C. A. Backer describes it in his *Flora van Java* (Afl. 3, p. 133, 1924) as a native of British India occasional in Java as an ornamental in gardens.

The determination of our material rests primarily on its identification at Buitenzorg, but it agrees sufficiently well with the *Botanical Magazine* plate for the identification to be accepted, at least provisionally. There are some points of difference between our plant and J. G. Baker's description (*Ann. Bot.* 7 p. 221. 1893). First, the inflorescence is not exactly " erect or finally drooping " : the bud is at first erect, as it must be in any *Musa*, but the peduncle reflexes sharply to the horizontal before the first bract lifts. At the same time it twists abruptly sideways through nearly a right angle, a habit not noticed in any other species. The effect, when the plant is stooling freely, is to hide the inflorescence under the leaves of the clump, which detracts from the value of this form as an ornamental. The rachis remains more or less horizontal and the male bud is never strictly pendent.

The bracts of our plant are not so much " bright red " as dark pink, or a somewhat washed-out crimson. The compound tepal, described as " bright yellow " is deep orange ; and though the fruit is said to be " pale yellow-green variegated with red", I have seen no trace of red on our specimens. None of these differences is in an essential character, and all together they suggest rather that the species is possibly variable than that our plant is wrongly determined. In any case, the descriptions and illustrations given here define the material used in our genetical researches as *M. sanguinea.*

*Continued from K.B., **1949,** p. 28.

A note may be added on *Musa assamica*. This has been listed in *Index Kewensis* as *M. assamica* G. Mann ex Baker, in Hook. f. Fl. Brit. Ind. **6** (1892) 263. Baker in Hooker's *Flora of British India* simply lists it under " imperfectly known species allied to M. sanguinea " as *M. assamica*, Cat. Hort. Bull 1871. 6. The reference is to *A retail list of new beautiful and rare plants offered by William Bull, F.L.S., F.R.G.S., F.R.H.S., F.R.B.S., and F.A.S.L.* issued in 1871. The entry runs :

" This is a peculiarly dwarf-habited and elegant species, and has been imported from Upper Assam. The slender pseudostems are about a foot and a half high, green, bearing a crowded tuft of several elliptic lanceolate leaves, which are stalked, about a foot in length, remarkably unequal-sided at the base, acute at the apex, and running out into a slender tendril-like point. The leaves are green, with a narrow purple border. It will make a good plant for table decoration, on account of its exotic aspect and moderate size and stature—1 guinea."

There is a note among the *Musa* material in Kew Herbarium in which Mann (who was responsible for collecting altogether four new species of *Musa* in Assam) states that he does not know which of the Assam species has been called " assamica". We may conclude fairly safely that the plants offered for sale were young specimens of one of the species subsequently fully described—viz. *M. sanguinea*, *M. velutina*. *M. mannii* or *M. aurantiaca*. It is quite impossible, from a description that would fit almost any *Musa* seedling at one stage of its life, to connect *M. assamica* specifically with any one of the four; and as the material has probably been extinct in cultivation for a good many years now, it is very likely to remain permanently *species ignota*.

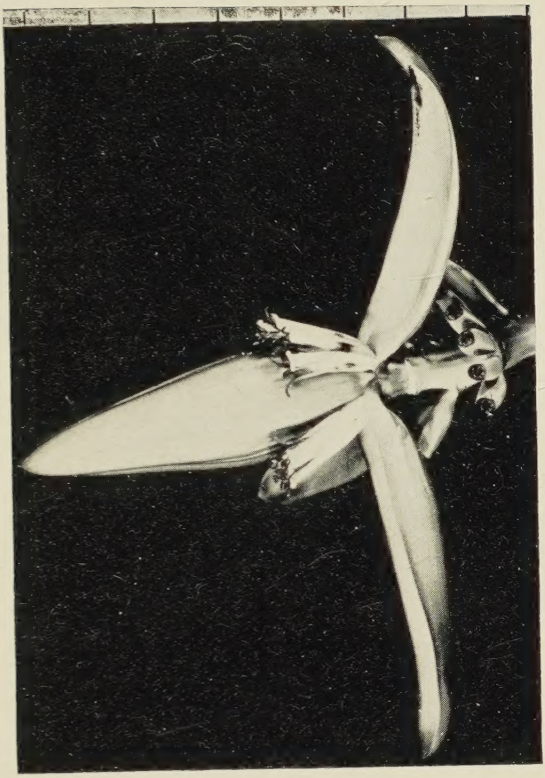
The description of our *M. sanguinea* is :

Plant stooling freely ; pseudostems 1–1½ metres high, 5–8 cm. in diameter at base, very heavily blotched with purple-brown, not at all glaucous. Leaf blades up to 1·5 m. long 40 cm. wide, truncate at apex, rounded at base, bright green above, paler beneath, when young slightly bronze-flushed beneath, the flush disappearing as the leaf ages ; midribs at first red on both surfaces, later becoming green above but remaining red below ; petioles 30–40 cm. long, with definite erect margins, expanded towards the base into a wing 1·5–2 cm. wide, this at first often corrugate, later becoming scarious.

Inflorescence horizontal, the peduncle flexing sharply as soon as the bud is clear of its subtending leaf-sheath ; peduncle red, 2 cm. thick, velvety with a white indumentum ; sterile bract usually one, often with a leaflike tip, the preceding leaf with a broadened and reddened petiole ; first fertile bract about 20 cm. long, 7·5 cm. wide, lanceolate, somewhat velvety ; basal flowers hermaphrodite, the fertile " hands " varying up to about 5, upper flowers male.

Hermaphrodite flowers 3–5 per bract in a single row ; ovary 3–3·5 cm. long, pale green ; compound tepal 4·5 cm. long, orange yellow, its lobes darker, the lateral lobes broadly ovate, 5 mm. long, with a spinelike dorsal appendage 1–2 mm. long ; free tepal about 4·3 cm. long, 2 cm. wide, ovate-lanceolate, its apex obtuse, scarcely apiculate ; stamens 5, fully developed, their filaments 1·5 cm., anthers 2·5 cm. long.

Plate 1



M. sanguinea Hook. f.
Fig. 1. Bud just after transition to male phase.

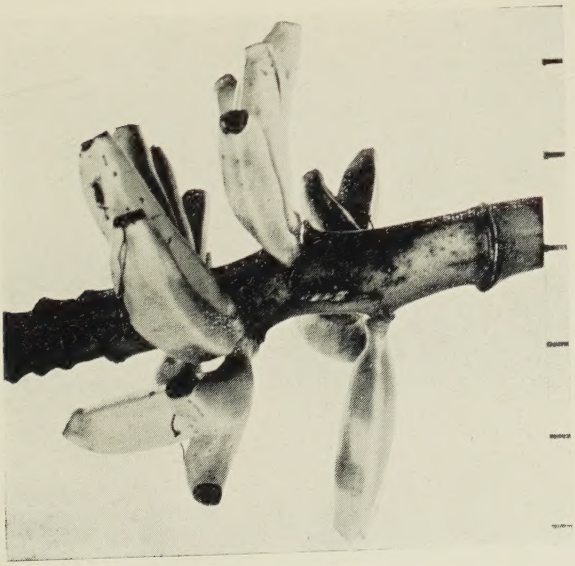


Fig. 2. Fruit bunch.
Scales in inches.

Photographs by K. S. Dodds.

[*To face page* 134

Plate 2.

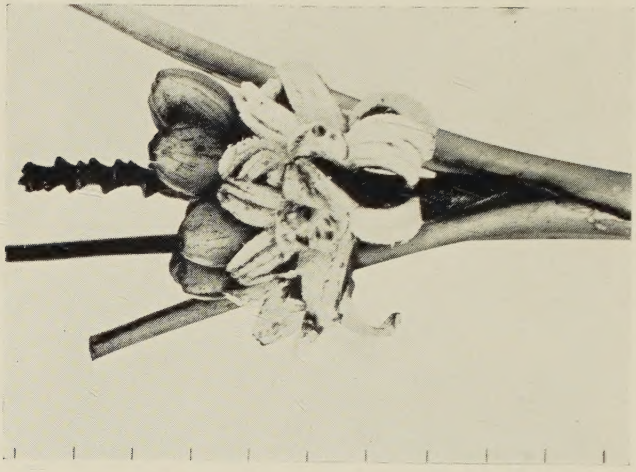


Fig. 2. Ripe fruit bunch, showing fruit dehiscing.
Scales in inches.

Fig. 1. *M. velutina* Wendl. et Drude
Bud soon after transition to male phase.

Photographs by K. S. Dodds.

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Male bud in advanced blooming narrow-turbinate, acute, the bracts convolute at the tip ; bracts rather narrowly lanceolate, lower ones about 10 cm. long, 4 cm. wide, obtuse, dark pink or pale crimson without, rather dull but not glaucous, sulcate, the inner surface at first almost white, striate, later darkening almost to the same colour as the outside. Bracts lifting one each day but persisting two days so that there are usually two open at once, then deciduous : whole bud usually aborting before the fruit is ripe.

Male flowers 5–3 per bract ; compound tepal 4 cm. long, orange, paling to nearly white at base, the lobes bright orange, about 4 mm. long, lateral ones with a short, recurved, spinelike dorsal appendage, the accessory teeth nearly as long as the lobes ; free tepal 3·5 cm. long, 1·3 cm. wide, oblong, obtuse, sometimes jagged-toothed near apex and irregularly truncate, scarcely apiculate.

Fruit up to 7 cm. long, 1·5 cm. in diameter, obsoletely 3–4-angled at maturity, narrowed gradually to a short (5 mm.) pedicel and similarly to a truncate apex, scarcely acuminate ; pericarp 1·5 mm. thick, ripening greenish yellow ; pulp white.

Seeds black, angulate-depressed, tuberculate, 5–6 mm. across and 3 mm. high.

CLASSIFICATION OF THE BANANAS.

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Imperial College of Tropical Agriculture, Trinidad, B.W.I.

III. Critical Notes on Species.

j. Musa velutina *Wendl. et Drude*, in Regel, Gartenfl. 65 t. 823 (1875).

This species was collected in Upper Assam by Gustav Mann and described by H. Wendland and O. Drude from a plant that flowered in the garden at Herrenhausen.

The material in the I.C.T.A. collection which we refer to it was raised from seeds reaching Trinidad in 1938 and 1939 through the kind offices of Mr. P. H. Carpenter of the Indian Tea Association's Experiment Station at Tocklai, Assam. Introduction no. 212 was of seeds collected by the Range Officer, Mariani range, and no. 244 was collected by the Divisional Forest Officer, Sibsagar Division. Both gave similar progenies, and the plants agree well with the original description and figures given by Wendland and Drude. There are minor points in which the agreement is not perfect, but the species is probably variable. J. G. Baker (in Ann. Bot. **7** (1893) 222) gives the distribution as " throughout the forests of Assam, *Mann* ", and I can find no cause to regard our material as specifically distinct.

There is a nomenclatural question to be considered in connexion with this species. Baker gives as a synonym: *M. dasycarpa* Kurz, in Journ. Agric.-Hort. Soc. India **14**, 381. If he was sure of the synonymy he should have used Kurz's name, which dates from 1865 ; but he adduces no evidence and cites no specimen. The entry in Kurz's paper is no

more than " 12. M. dasycarpa Kurz. Fruits hairy (Assam)". I have found no Kurz specimen of *M. dasycarpa* at Kew, but there is a sketch there purporting to be of the type specimen in Calcutta, and this is possibly the evidence on which Baker based his synonymy. The drawing certainly strongly suggests identity with *M. velutina*. As there may well be more than one hairy-fruited *Musa* in Assam, I hesitate to confirm the synonymy without access to the type specimen itself, but regard it as probable that further study may establish *M. dasycarpa* Kurz as the valid name for the species here called *M. velutina*.

M. velutina belongs to the section *Rhodochlamys*. Its most interesting feature is the behaviour of its fruit, of which the pericarp splits at maturity and curls back in irregular valves from apex to base, exposing the central mass of seeds and pulp.

Our plants often flower at less than a metre high, and although they sucker freely the tillers flower so early that they do not build up much reserve in the rhizomes, so that we have to treat the species as an annual to keep the stock alive, and sow fresh seeds at frequent intervals. This may perhaps be a photoperiodic reaction due to our considerably lower latitude, or it may be due to other climatic factors. The fact is mentioned because the description given here may not fit the wild species in all particulars. *Parkinson* 1765 in Herb. Kew., which has been determined as *M. velutina* by C. E. C. Fisher is described as " as high as a man" (*Kew Bull.* 1931, p. 29). The Herrenhausen plant flowered at 1·2 metres.

A full description of our material follows:

Plant stooling freely ; pseudostems up to 1·5 metres high, 7 cm. in diameter at base, often smaller, yellowish green, devoid of wax; leaf-blades up to 1 m. long, 35 cm. wide, truncate at apex, unequal-sided at base, one side more or less rounded, the other broadly wedge-shaped ; lamina shining dark green above, paler beneath but scarcely glaucous, slightly bronze flushed beneath when very young, the flush disappearing as the leaf matures ; midribs green above, red beneath ; petioles up to 45 cm. long, distinctly margined, the margins at first almost meeting over the adaxial groove, later erect, expanded at base into wings more than 1 cm. wide, very soon becoming scarious.

Inflorescence quite erect, the peduncle red, 2 cm. thick, heavily clothed with white pubescence ; last leaf with a broadened petiole developing red colour, following this a sterile bract 15–20 cm. long, which persists; basal flowers hermaphrodite, the fertile " hands " 2–4, upper flowers male.

Hermaphrodite flowers 3–5 per bract in a single row ; ovary 3–3·5 cm. long, 1–1·5 cm. wide, rather acutely trigonous or 4-sided according to position, densely pubescent ; compound tepal 3 cm. long, bright orange with a pink flush on the back, its lateral lobes 4 mm. long with a filiform dorsal appendage 3 (or sometimes up to 5) mm. long, the centre lobe broader, shorter, and without appendage ; free tepal nearly as long as the compound, white, oval, emarginate at apex ; stamens usually less than five fertile, one or more being vestigial, the fully developed ones as long as the style.

Male bud more or less turbinate, acute or acuminate, commonly aborting after producing about a dozen " hands " of male flowers. Bracts convolute at the tip, pale pink on the outer surface, not conspicuously sulcate, darker within ; one raised at a time, strongly revolute on fading, early deciduous.

Male flowers about 5 per bract, generally in one row but with a tendency when more numerous to form 2 rows ; compound tepal 3·5 cm. long, orange-yellow, with a pink flush on the back, rudimentary ovary also pink, lobes of tepal orange, barely 2 mm. long, the lateral ones with a minute dorsal appendage ; free tepal 3·5 cm. long, 1 cm. wide, oblong, sometimes jagged-toothed towards the apex, with a short broad acumen ; stamens finally exserted, their filaments longer than the anthers.

Fruit bright pink, about 7 cm. long, 3–4 cm. in diameter, pubescent like the peduncle, broadly truncate at apex, rounded and subsessile at base. Pericarp 3–4 mm. thick, splitting at maturity and separating in irregular strips from apex to base, exposing the central mass of white pulp and seeds.

Seeds black, tuberculate, irregularly angulate-depressed, 4–6 mm. across, 2–3 mm. high.

HELIOTROPIUM PERSICUM AND H. UNDULATUM.

B. L. Burtt.

Heliotropium persicum (Burm. fil.) Lam. and *H. undulatum* Vahl are adjacent species in Boissier's Flora Orientalis (4 : 147. 1879) and the material in the Kew Herbarium was found to be considerably confused. Investigation of the original description and illustration of *H. persicum* gave rise to the strong suspicion that the true plant of this name was no *Heliotropium* but what we now know as *Sericostoma kotschyi* (Boiss. et Hohen.) Franch. An approach was accordingly made to Professor Dr. C. Baehni, Geneva, who has most kindly examined Burmann's specimen ; he confirms that it certainly belongs to *Sericostoma* and has the conspicuous zone of yellow hairs round the mouth of the corolla tube which is the hall-mark of that genus. Burmann's specimen actually has longer leaves than the type of *S. kotschyi*, but in this it agrees with Bornmüller 521 from Bender Abbas, S.E. Persia. *S. kotschyi* appears to be a somewhat variable species and there is little doubt that these specimens should be included in it.

The earliest name for the plant which has for so long been called *Heliotropium persicum* is *H. ramosissimum* (Lehm.) DC. which was based on one of Sieber's Egyptian plants. It is characterised by its erect habit and somewhat lax inflorescences.

H. undulatum Vahl proves to be an illegitimate name, owing to the citation of the synonym *Lithospermum hispidum* Forsk. ; for the epithet *hispidum* was at that time, though it is no longer, available for use in

Heliotropium. The name *H. undulatum* Vahl must therefore be discarded. It is to be replaced by *H. bacciferum* Forsk., of which the type specimen has kindly been sent on loan to Kew by the Director of the Botanical Museum, Copenhagen. *H. bacciferum* evidently takes its name from the blister-like outgrowths on the back of the nutlets. This is the main feature which distinguishes *H. bacciferum* from Forskal's *Lithospermum hispidum*, but it is of doubtful systematic value and is also found occasionally in both the allied species *H. pterocarpum* (DC.) Vatke and *H. tuberculosum* Boiss. *H. bacciferum* is typically a prostrate plant with dense inflorescences.

A more detailed investigation of the taxonomy of this group is in hand, but the publication of this preliminary note is desirable in order to justify the unfamiliar names which are being taken into use. They are :—

Sericostoma persicum (*Burm. fil.*) *B. L. Burtt*, comb. nov.

Syn. *Heliotropium fruticosum* var. *persicum* Burm. fil. Fl. Indica, 41, tab. 19 fig. 1 (1768).

H. persicum (Burm. fil.) Lam. Encycl. Méth. 3 : 94 (1789).

Lithospermum kotschyi Boiss. et Hohen. in Boiss. Diagn. 1 ser. 4: 49 (1844); Boiss. Fl. Or. 4: 219 (1879).

Sericostoma kotschyi (Boiss. et Hohen.) Franch. in Révoil, Pays Çomal. 47 (1882).

Heliotropium bacciferum *Forsk.* Fl. Aeg.-Arab. 38 (1775).

Syn. *Lithospermum hispidum* Forsk. Fl. Aeg.-Arab. 39 (1775).

Heliotropium undulatum Vahl, Symb. Bot. 1: 13 (1790); Boiss. Fl. Or. 4: 147 (1879).

H. crispum Desf. Fl. Atlant. 1: 151, tab. 41 (1798).

Heliotropium ramosissimum (Lehm.) *DC.* Prod. 9: 536 (1845).

Syn. *H. undulatum* var. *ramosissimum* Lehm. Ic. Descr. Stirp. 1: Ic. Asperifol. 24, tab. 40 (1831).

This species has been widely misidentified as *H. persicum* Lam., and that is the name under which it appears in Bossier's Flora Orientalis.

NOTES ON CYPERACEAE: XIX*.

A New Genus of Scirpeae.

E. Nelmes.

The *Cyperaceae* collected on the Netherlands Kwae Noi River Basin Expedition, 1946, includes two very interesting plants. One is a new species of the most " primitive " group of *Carices* (see Kew Bull. 1949, 38–40), and the other is a still more remarkable sedge, which appears to constitute a new genus of the tribe *Scirpeae*.

Even in its general appearance it looks unfamiliar. With some knowledge of the family, one can usually, after only a cursory examination, assign any given complete specimen to its correct genus, but this Siam plant proved not so readily classifiable. It has a bulbous-woody base, semi-sheathed by the bases of numerous crowded leaves, and from which arises an erect, rigid, scabrid stem, 10–20 cm. tall, bearing terminal umbelled spikes, which are slenderly cylindric, 1–3 cm. long and about 3 mm. in diameter.

Its achene or nut, which is one of the chief distinguishing characters in the *Scirpeae*, is quite distinct from that of any described genus in the tribe. Its style, jointed with the nut, excludes it from *Scirpus*, and the persistent style-base puts it out of *Fimbristylis*, no species of which, moreover, has anything like such long and such linear-cylindric spikes. Its persistent style-base is not minute, like that of *Bulbostylis*, but large and spongy, like that of *Eleocharis*, which genus differs radically, however, by its leafless and unispicate condition. There is a further distinction from *Bulbostylis* in the subbiconvex and polished character of the nut. Finally, the nut of this new genus has a character apparently unique in the family : the dorsal face is divided, by a slender, concave-curved grove across it, just below the middle, into two distinct parts, a lower tapering one, and a rather larger rounded upper one which has a raised (pulvinate) surface.

It is intended that this preliminary note shall be followed by a fuller account, with illustrations, in Hooker's Icones Plantarum.

Tylocarya *Nelmes* ; genus novum, a ceteris generibus *Scirpearum* praesertim nucibus facie dorsali in duas partes divisis distincta, parte inferiore attenuata, parte superiore pulvinata-convexa rotundata.

Tylocarya cylindrostachya *Nelmes*, species nova.

Herba ut videtur perennis, caespitosa. *Culmi* stricti, erecti, rigidi, nudi, 10–22 cm. alti, 1·5–2 mm. crassi, multistriati, subteretes, scaberuli, brunnei, basi lignoso-bulbosa foliis numerosis et vaginis reliquiis fusco-fibrosis circumdata. *Folia* culmo breviora vel longiora, rigida, saepe curvata interdum flexuosa, plerumque involuto-cylindrica, inferne interdum planiuscula, 0·5–3 mm. lata, tenuiter nervosa, cinereo-viridia, crassiuscula, parte marginali scaberula excepta laevia vel sublaevia, apicem firmum versus attenuata, basi marginibus membranacea sed haud vaginantia. *Inflorescentia* simpliciter vel composite umbellata, rarius ad spicam singulam terminalem redacta. *Umbellae* aut simplices, e spicis 3–4 sessilibus vel pedunculatis sistentes, aut compositae, additis pedun-

*Continuation of " Notes on Carex", I-XVIII, K.B. 1937-49.

culis (radiis) longioribus apice spicas sessiles plerumque geminatas (rarius praeterea spicam breviter pedunculatam) gerentibus. *Radii* 3–4, 2–2·5 cm. longi (spicis exclusis), rigidi, costati, sulcati, obscure trigoni, inferne laeves, superne scabriusculi. *Bracteae* usque 6 vel plures, subfoliaceae, brevissimae vel umbellam aequantes ; *bracteolae* vix subfoliaceae, squamiformes, aristatae ; aristae latae, virides, 4–6 mm. longae. *Spicae* cylindricae, 1–3 cm. longae, circiter 3 mm. crassae, densiflorae, pallide brunneae. *Glumae* dense imbricatae, ovatae vel ovato-lanceolatae, apice acutae usque obtusissimae, 3–4 mm. longae, 2–3 mm. latae, planiusculae vel subcymbiformes, lateribus tenuissimis enerves vel subenerves, glabrae, albidae, triente medio minute et sparse vel subdense furfuraceo-subadpresso-setulosae versus minute rubido-maculatae, nervo medio et nervis 2 lateralibus validis rubidis sursum coalitis ex apice saepe breviter excurrentibus. *Stamina* 3 ; filamenta ligulata. *Nux* 1–1·25 mm. longa, 0·8–1 mm. lata, ± pyriformis, biconvexa sed facie ventrali costa mediana tenui instructa, laevis, nitida, olivaceo-brunnea, facie dorsali in duas partes sulca tenui curvata concava infra medium divisa, parte inferiore attenuata, parte superiore convexo-pulvinata rorundata, basi truncata haud stipitata, apice rotundato-truncata erostrata. *Stylus* rubidus, complanatus, basi percrassa in apice nucis persistente. *Stigmata* 2.

Siam : Brangkasi ; about 100 km. south of Wangka, on sandbank near river, rather rare, 150 m., 22 June 1946, *G. den Hoed and A. Kostermans* (Kwae Noi River Basin Expedition, 1946, No. 968).

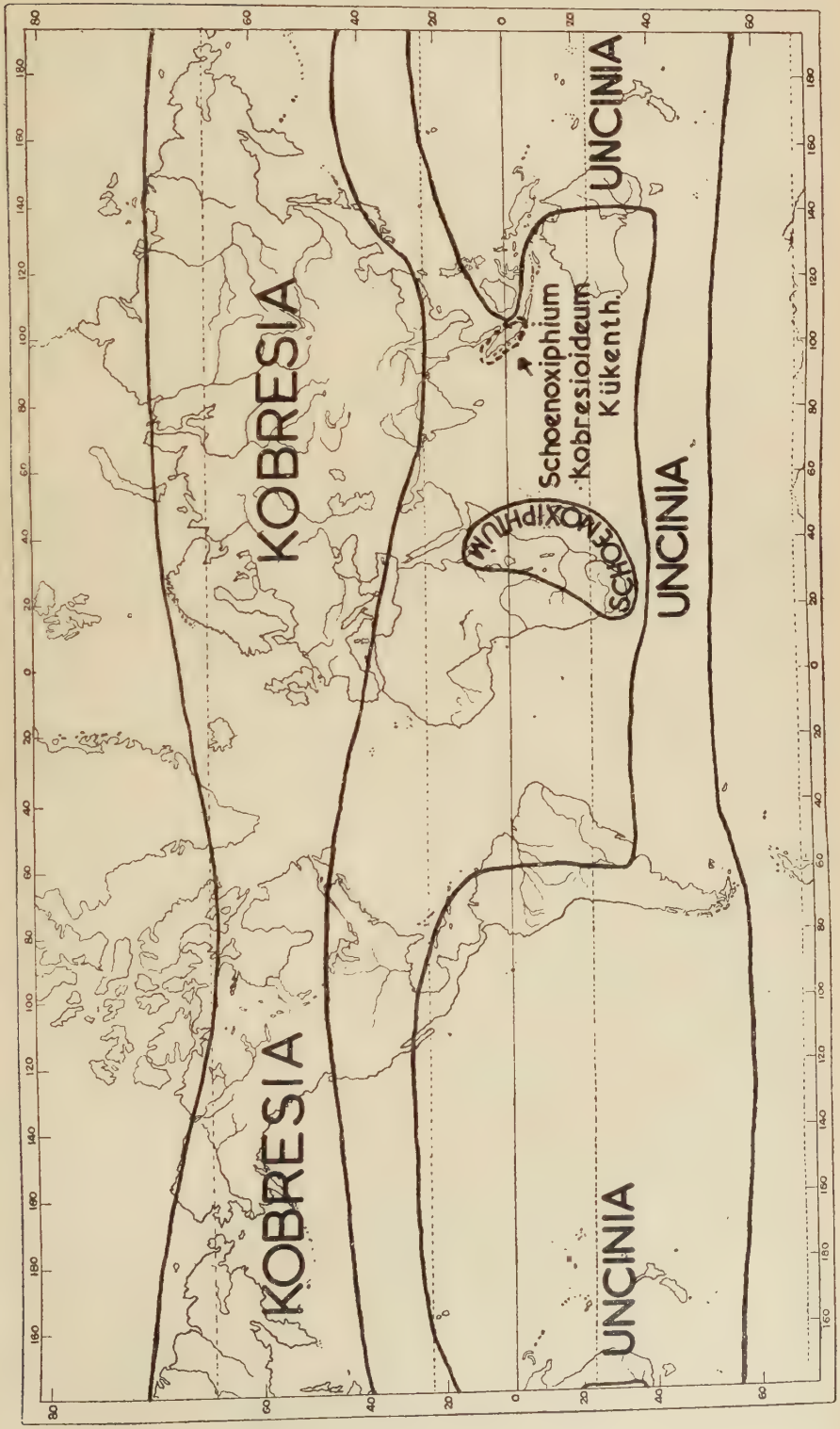
NOTES ON CYPERACEAE: XX.

The Genus Uncinia in Malaysia.

E. Nelmes.

The area of distribution of *Uncinia* lies mainly in the southern hemisphere. One of the two sections into which C. B. Clarke (Journ. Linn. Soc. 20: 389–403: 1883) divided the genus, Sect. *Platyandra*, extends northwards from the extreme south of South America, including the Falkland Islands, along the Andes to Mexico and to Jamaica. The other section, Sect. *Stenandra*, occurs throughout New Zealand and in the islands lying to the south and south-west of it, extending northwards from Tasmania through eastern Australia to New Guinea, Borneo, and the Philippines. One member of this section is found in Hawaii, and a few encroach on the *Platyandra* area in South America.

In addition to these more or less longitudinal distributions, the American section stretches out an arm (or a leg !) from its base eastwards to Tristan da Cunha ; and the Australasian section extends a western arm to the islands of Kerguelen, New Amsterdam, and St. Paul. Now, during the preparation of this paper, by an appropriate coincidence, specimens of an *Uncinia* have come to Kew from Marion Island, south-east of the Cape of Good Hope. The two arms have thus met, strengthening one's impression that the genus had an Antarctic origin.


KOBRESIA
KOBRESIA
UNCINIA
UNCINIA
UNCINIA
Schoenoxiphium
kobresioideum
Kükenth.
SCHOENOXIPHIUM

Kükenthal (Engl. Pflanzenreich, IV, 20: 50–67: 1909) closely follows Clarke, dividing 23 of the 24 species recognised in the Pflanzenreich into Clarke's two sections, and creating a separate subgenus, Subgen. *Pseudocarex*, for the twenty-fourth.

Uncinia is an extremely homogeneous group, its inflorescence invariably consisting of one terminal, androgynaeceous spike, and the remaining characters showing a small range of variation.

It is not intended here to discuss the interrelationships of the members of the tribe *Cariceae*, but it is interesting to note that three of its genera, *Schoenoxiphium*, *Kobresia*, and *Uncinia* occupy areas which do not overlap one another, whilst the remaining genus, *Carex*, covers them all. *Schoenoxiphium* is confined to South and East Africa and Madagascar, *Kobresia* encircles the northern hemisphere, above the northern limits of *Uncinia*, the area of which, as we have seen, lies mainly in South America and Australasia.

It may be mentioned in passing that at the time of writing there is on the way to Kew, on loan from Buitenzorg, a remarkable plant collected on Atjeh Mountain, Sumatra, by Dr. van Steenis. This is *Schoenoxiphium kobresioideum* Kükenthal (Bull. Jard. Bot. Buitenzorg, Sér. III, 16: 312–313 : 1940), described by its author as forming a link between the two genera which are united also in the name chosen for it.

The above-mentioned plant, with a large amount of *Carex* material, has been borrowed for study in connection with the preparation of the *Cariceae* for the projected Flora Malesiana, and it is the main purpose of this paper to explain our present knowledge of *Uncinia* in Malaysia and to invite help, by the loan and/or gift of specimens, in its further elucidation.

The only references to Malaysia in Kükenthal's account of *Uncinia* in Engler's Pflanzenreich are two. Under *U. riparia* R. Br. he cites " Neu-Guinea : Mt. Knutsford (MacGregor ex F. Mueller in Trans. Roy. Soc. Victor. [1889] 36)," and there is the same citation (except for p. "37") under var. *hookeri* (Boott) Kükenth. This species has a wide Australasian distribution, but var. *hookeri* is known only from Campbell and Lord Auckland islands apart from its reputed occurrence in New Guinea. I hope to have an opportunity of examining these MacGregor specimens in the near future.

So far as I know, Mr. and Mrs. Clemens made five gatherings of *Uncinia* in New Guinea and one in Borneo. Only this last is represented in the Kew Herbarium, but I have seen, on loan from the Arnold Arboretum, three of the five New Guinea gatherings. Kükenthal (Engl. Bot. Jahrb. 69: 261: 1938, and 70: 464: 1940) determined the two Clemens numbers which I have not seen, 6069 pro parte and 7397, as *U. rupestris* Raoul and *U. compacta* R. Br. respectively. Both were collected on Mt. Sarawaket, in north-east New Guinea. The other three gatherings (nos. 5547, 6070 and 6070A) were identified by him (l.c. 69: 261: 1938) as *U. riparia* R. Br. As represented in the herbarium of the Arnold Arboretum, these are treated as three new species in this paper, and two of them are described below. The other, no. 5547 pro parte, is in too poor a condition for adequate description. The Clemens Bornean plant no. 29004, in the Kew Herbarium, is considered to be

conspecific with one of the New Guinea species described below, *U. subtrigona*, and is made the type. Each of the three gatherings seen from New Guinea is a mixture of two species!

The Clemens New Guinea gathering in the Arnold Arboretum, which is not sufficiently complete to describe (north-east New Guinea, Morobe District, Mt. Sarawaket, 8–10,000 ft., April 1937, no. 5547 pro parte) seems most nearly related to *U. riparia*, differing principally in its shorter, and less strongly nerved, narrower, utricles. It is also closely related to *U. subtrigona*, which is distinguished from it by plano-convex or obscurely trigonous not distinctly trigonous), nerveless (not nervose) utricles. I should like to see good, fruiting material of this, as well as of nos. 6069 p.p. and 7397, mentioned above.

Finally, specimens of *Uncinia* have been collected in the Philippines on at least two occasions. The first gathering was collected by Curran, Merritt, and Zschokke (Bur. of Sci. no. 16140), and recorded as *U. rupestris* var. *capillacea* Kükenth. in a paper by E. D. Merrill and M. L. Merritt on the Flora of Mt. Pulog, Luzon (Philipp. Journ. Sci. Bot. 5: 334: 1910), and the second, collected by Elmer (No. 10637) on Mt. Apo, Todayo, District of Davao, Mindanao, was included with the former by Kükenthal, under the same name, in his account of the *Cariceae* of the Philippines (Philipp. Journ. Sci. Bot. 6: 58: 1911). I have not seen these plants ; neither number is represented at Kew. *U. repestris* Raoul var. *capillacea* Kükenth. (Engl. Pflanzenr. IV. 20: 64: 1909) was based on three New Zealand gatherings: two from South Island and one from Stewart Island.

Uncinia sclerophylla *Nelmes*, sp. nov. ; ab *U. riparia* R. Br. culmis brevioribus foliis latioribus rigidis squamis majoribus magis fuscis utriculis saepe fusco-rubidis distinguenda.

Culmi 12–20 cm. alti, inferne 1–1·25 mm. crassi, sursum demum graciliores, costati et sulcati, trigoni, angulis inferne obtusis laevibus superne acutis scabridis, erecti vel curvi, basi foliis 4 -8 vaginatis, superne nudi. *Folia* plerumque culmum paullo superantia, 2 -4 mm. lata, planiuscula vel conduplicata, rigida, crassiuscula, erecta vel curva, valde nervosi, inferne vel basi tantum laevia supra et marginibus superne scabrida, infra apicem attenuatum versus nervo mediano scabrida; *vaginae* dorso fusco-brunneae, ventre membranaceae mox demum fissae. *Spica* 1, terminalis, androgynaecea, ebracteata, tenuiter cylindrica, 2·5 –5 cm. longa, 3 -4 mm. crassa, laxi- vel sublaxiflora, parte mascula non ultra 1 cm. longa. *Squamae femineae* lanceolatae vel oblongo-lanceolatae, apice plerumque obtusae sed interdum subacutae, cymbiformes, 5 - 8·5 mm. longae, 2 3 mm. latae, crassiusculae, nervosae, pallide usque fusco-brunneae vel fusco-spadiceae, interdum marginibus angustissime albo-hyalinae, vitta mediana et interdum basi pallidiore, nervo mediano apicem haud attingente. *Utriculi* anguste oblongo-elliptici, concavo- vel plano-convexi et vix compresso-trigoni, 5·5 -7·5 mm. longi, 1·1 -1·25 mm. lati, submembranacei, glabri laeves, utrinque tenuiter et interdum subobscure plurinerves, stricti, plerumque demum subpatuli, inferne pallidi, superne viriduli et saepe fusco-rubidi, basi per 1·5 -2 mm. compresso-spongiosi pseudostipitati attenuati, apice in rostrum compresso-conicum fusco-rubrum 1–1·5 mm. longum ore subintegrum

subtruncatum interdum angustissime albo-hyalinum demum erosum sensim abeuntes. *Achenium* oblongum apice rotundatum, basi leviter attenuatum, trigonum vel obscure trigonum, facie ventrali concavum, 3–3·5 mm. longum, 1–1·2 mm. latum, punctulis minutis pallidis elevatis parce sparsum, pallide brunneum, brevissime rostratum, apice leviter discoideo-annulatum. *Stylus* basi subincrassatus, in rostro achenii subpersistens. *Stigmata* 3. *Rhachilla* utriculum per 4–5 mm. superans.

North-east New Guinea: Morobe District; Mt. Sarawaket, 3000 m., 10 April 1937, *Clemens* 6070A (type, in Arn. Arb. Herb.); April 1937, Clemens 6070 (pro parte [different gathering from 6070A]) (Arn. Arb. Herb.).

The broad rigid leaves and stems, and the dusky colour of the spikes (glumes and utricles), give this species a general appearance very distinct from the other Clemens gatherings included in this paper.

Uncinia subtrigona *Nelmes*, sp. nov.; ab *U. flaccida* S. T. Blake utriculis multo angustioribus, ab *U. rupestri* Raoul spicis laxi- vel perlaxi-floris glumis albidis ab utraque insuper utriculis plano-convexis vel obscure trigonis distinguenda.

Laxe caespitosa. *Rhizoma* tenue, brevissimum. *Culmi* obscure vel obtuse trigoni, 15–30 cm. alti, usque 1 mm. crassi, ± erecti sed subflaccidi, laeves, costati, sulcati, basin versus foliati. *Folia* culmo breviora vel longiora, 1–2 mm. lata, planiuscula vel marginibus revoluta vel canaliculato-duplicata, crassiuscula, apice interdum leviter circinnata, basin versus utrinque laevia, apicem attenuatam versus pagina et marginibus scaberula, inferiora in vagina aphylla brunnea redacta; *vaginae* pallide brunneae, ventre membranaceae. *Spica* 1, terminalis, androgynaecea, ebracteata sed glumis 1–2 inferioribus longe aristatis subfoliaceis apicem spicae aequantibus vel superantibus, tenuiter cylindrica, 2–5 cm. longa, subfructu 2·5–4 mm. crassa, laxi- vel perlaxi-flora, parte mascula 3–8 mm. longa. *Glumae femineae* lanceolatae vel oblongo-lanceolatae, apice acutae vel obtusae, cymbiformes, superne marginibus involutae, inferne saepe rigide incurvae, 4·5–5·5mm. longae, 1·5–2 mm. latae, translucentes, albidae, enerves vel tenuissime nervosae sed vitta mediana viridi, nervo mediano et nervis 2 lateralibus pallidis sursum coalitis ad apicem haud attingente, utriculo maturo caducae. *Utriculi* plano-convexi vel obscure trigoni, anguste elliptici vel oblongo-elliptici, 5–5·75 mm. longi, 1–1·2 mm. lati, submembranacei, glabri, enerves vel subenerves, stricti vel substricti, demum leviter patuli, inferne pallidi brunneo-tincti, superne pallide- vel cinereo-viriduli basi per 1–1·8 mm. compresso-spongiosi pseudo-stipitati attenuati, apice in rostrum compresso-conicum circiter 1 mm. longum ore subintegrum obliquum brunnescente demum erosum sensim abeuntes. *Achaenium* oblongum, apice rotundatum, basi leviter attenuatum, trigonum vel obscure trigonum, 2·5–3 mm. longum, 1 mm. latum, brevissime rostratum, stramineum vel brunnescens. *Stylus* basi incrassatus, interdum pallidus in rostro achaenii subpersistens. *Stigmata* 3. *Rhachilla* utriculum per 3·25–6 mm. superans.

Borneo: Mt. Kinabalu, Upper Kinabalu, Paka 3300 m., 26 March 1932, *J. & M. S. Clemens* 29004 (type, Kew Herb.).

North-east New Guinea: Morobe District; Mt. Sarawaket, 2400–3000 m., April 1937, *Clemens* 5547, pro parte, 6070, pro parte (Arn. Arb. Herb.).

U. riparia var. *stolonifera* Steen. & Kükenth. in Bull. Jard. Bot. Buitenz. Sér. III, 13: 201 (footnote "Stolonibus longis tenuibus") is based on *Clemens* 32341, 32333 and 29004 (in this order), all from "Mt. Kinabalu, at 3300 m.", but I have not cited this name under *U. subtrigona* because the Kew specimen is tufted, without stolons, and does not appear to have a creeping ("stoloniferous") rhizome. It may be a different plant : the Clemens sedge gatherings are frequently mixed.

Mosses of Guatemala*. This well-produced flora is based mainly on the collections of Standley, Steyermark, and Sharp carefully studied by the author. Descriptions, keys, essential synonymy, and distribution are given for the approximately 519 species which are divided amongst 205 genera. There is an adequate index and list of references and 190 black and white text figures. This is an important contribution to American bryology as is indicated by the short but interesting introduction.

Guatemala, stretching across the Cordilleran axis from the Atlantic to the Pacific has a diversified terrain. Amongst the mosses, Mexican species are abundantly represented, but the most significant feature is the occurrence of numerous species typical of the northern United States and Canada. It is suggested that these were forced southward during glacial times and persisted in isolated communities in the highlands of Guatemala even after the retrograde migration had taken place. While the Cordillera served as a main highway of north to south migration, immigration of typical Andean species occurred in the opposite direction. There is a small group of Brazilian species of genera newly recorded for North America.

The Guatemalan moss flora may be roughly divided into three zones. Up to about 1500 m. there are lowland mosses broadly representative of the Caribbean region. From 1500 or 2000 m. up to 3500 m. is a second zone with a much more diversified flora, with many surprising vagrants from far distant northern and southern latitudes. Finally, the rocky summits of the higher mountains, up to 4600 m. are "alpine" in character. The great mixture of phytogeographical types indicates that Guatemala is one of the principal focal points of geographical distribution in Central America. The endemic species are relatively few : 58 species or 11 per cent. of the total known moss flora are not known outside of Guatemala.—W. B. Turrill.

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*Mosses of Guatemala, by Edwin B. Bartram, Fieldiana : Botany, vol. 25, published by Chicago Natural History Museum, 31 Jan. 1949, 4 dollars.

Flora Malesiana. The first part to be published of the Flora Malesiana* is of wide general interest. There are in this part a plan of volumes 1 to 4, an introduction, general considerations (including variations mostly induced by the environment and the beginning of variations bound to the genotype), taxonomic revisions, and sample treatments. In a preface, Dr. L. G. M. Baas Becking, Director of the 's-Lands Plantentuin, comments adequately on the wide cultural value of a great project that to be completed must involve very extensive teamwork. All botanists who know what progress has already been made will agree that " To the General Editor, Dr. C. G. G. J. van Steenis, we all want to express our gratitude for his initiative, for his boundless energy and, especially, for his faith in this project."

There are very useful discussions in the introduction. One may note that on " the undesirability of compiling, at this stage, local floras in Malaysia " and on " sequence of publication". As regards the latter it has been decided to adopt the scheme of " opportunity sequence " as opposed to a sequence " in the natural system". The editor remarks that one is up against " the existence of several ' natural systems ' " and any system now adopted may be obsolete when the flora is finished.

Under " general considerations " an account of variations is given with special reference to the Malesian flora. Twenty-four kinds of phenotypic modifications are grouped into four major classes : intrinsic, climatic, edaphic, and biotic. The phenotypes of hosts due to viruses should have been included in the subdivision 18. The consideration of genotypic variations is only just commenced in this part. Its continuation will be awaited with interest.

The taxonomic revisions published in part 1 are those of: *Aceraceae*, *Philydraceae*, *Ancistrocladaceae*, *Aponogetonaceae*, *Burmanniaceae*, *Sphenocleaceae*, *Nyssaceae*, *Sarcospermaceae*, *Stackhousiaceae*, and *Actinidaceae*.

" Sample treatments " here published are those of Malaysian Plant Collectors and Collections by Mrs. M. J. van Steenis-Kruseman, Malaysian Plant Life by C. G. G. J. van Steenis, and Malaysian Plant Geography by C. G. G. J. van Steenis. The only general comment is in the form of a question: how far is it advisable to publish the Plant Life and the Plant Geography before completion of the taxonomic accounts of the flora ?

The hearty good wishes of all his friends at Kew for the successful completion of this boldly conceived venture are here recorded as an encouragement to the General Editor.—W. B. Turrill.

Flora Malesiana. Series I. Spermatophyta, volume 4, part 1, Noordhoff-Kolff, N.V., Batavia, 1948. General editor Dr. C. G. G. J. van Steenis.

THE LIMES AS AMENITY TREES AND BEE PASTURAGE.

R. Melville.

The limes or lindens, *Tilia* spp., are popular trees for planting in streets, avenues and parks, where they cast a pleasant shade and during the months of June and July perfume the air with a wealth of pendant white blossoms. The flowers secrete an abundance of nectar, which in many suburban areas is the principal source of honey for beekeepers. If the nectar flow on the limes fails through adverse weather conditions, or constant rain prevents the bees from working the blossoms, the suburban beekeeper may obtain little or nothing for his labours, as happened in 1948. While depending mainly on the limes for his honey surplus, the beekeeper provides a free pollination service to the rest of the community. This is especially valuable for effecting the setting of fruit and there are often considerable numbers of tree and bush fruits scattered through suburban gardens. The vagaries of the weather during April prevent any direct reward from accruing to the beekeeper for this pollination service more often than about one year in five. The community at large is therefore indebted to the beekeeper. Fortunately the general desire to decorate our homes and places of recreation with flowering plants is in complete harmony with the beekeeper's need for a continual succession of nectar and pollen bearing blossom. Much more could be done than at present to improve both the floral display and the nectar supply.

Municipal authorities could with advantage keep beekeepers' requirements in mind when considering plans for amenity planting. During the last century a considerable number of hardy flowering trees and shrubs has been introduced, but there has been a long delay in making effective use of the introductions. Among the limes, although a number of new species is available, the common, broad leaved and small leaved limes are planted almost exclusively and this in spite of several disadvantages as street trees. The broad leaved lime, *T. platyphyllos* Scop. and its hybrid the common lime, × *T. europaea* L., are forest trees reaching, under favourable conditions, a height of 120 feet. They are inherently unsuitable for the confined spaces of a suburban street and frequently need lopping. The other parent of the common lime is the small leaved lime, *T. cordata* Mill., a somewhat smaller tree not often exceeding 60 ft. in height, though it suffers, in common with the other two, from aphid infestations with the consequent nuisance caused by honeydew and the black filth of the sooty moulds that invade it. Honeydew is as much disliked by the beekeeper as the borough engineer, since bees often gather it to the deteriment of the honey, which in the extreme may be rendered black and of evil flavour.

Many of the less familiar limes remain free or almost free from aphids in seasons when the common kinds are severely infested. Observations made in recent years on trees in the arboretum at Kew show that the flowering times of the species now in cultivation together extend over a period of two months. A judicious choice of species for amenity planting would provide blossom over a considerably longer period than at present, while at the same time the worst of the disabilities of the common limes could be avoided.

The date on which individual lime trees flower is determined partly by the species and partly by weather conditions. The species tend to open their blossoms in the same sequence, year by year, at least if the same individuals are kept under observation. Individuals of a species may differ by as much as ten days or more in the time of onset of flowering, but the majority flower together and follow in the regular sequence of the species. Weather conditions during the preceding months have a marked effect upon the actual date at which flowering begins and if a cold spell intervenes during the flowering period, the flowering time of the species in blossom at that moment is extended and the opening of the later species postponed. Apart from these considerations, the flowering of the limes usually follows the sequence shown in Fig. 1. This is based on observations made in 1943, checked by notes made in other seasons.

The dates at which the first flowers were seen to open is shown in the figure by a stroke. The full flowering period was noted only for *T. platyphyllos*, *T. europaea* and *T. cordata* and is shown by a full line ended by a stroke. In the majority of species, the effective flowering period lasts about a fortnight unless protracted by adverse weather or shortened by very hot weather. Of this period, the first week is the most important for the beekeeper, as then the nectar flow is at its peak. In the later stages of flowering, when freshly opened flowers are scattered sparingly over the trees, they are often ignored by the bees. The useful nectar bearing period is roughly that indicated for the remaining species by a full line.

The earliest species to flower is *T. platyphyllos* and the start of flowering shown on June 10 is that for average members of the species. The earliest tree of this species encountered opened its first blossoms on June 1st. In other seasons the same tree was consistently 7–10 days earlier than other individuals. The common lime, × *T. europaea*, is the second to flower about 5 days later and the two together give about a fortnight's effective nectar flow in favourable seasons. This is extended somewhat by *T. cordata*, where it is planted with the others in sufficient quantity.

The American lime, *T. americana* L. is about 2 days later than the common lime, but it does not grow well in the British climate and is not recommended. The Manchurian lime, *T. mandshurica* Rupr. & Maxim. is about 6 days, *T. maximowicziana* Shiras., a Japanese species, about 10 days and the Mongolian lime *T. mongolica* Maxim., about 13 days later than the common lime. All three are worthy of more attention. The first introduction of *T. mandshurica* in 1871 appears to have been a poor strain and it did not flower for many years. The present tree, obtained from the Arnold Arboretum in 1910, is flowering quite well, but not so freely as it does in warmer climates, where each bract may bear up to 15 flowers ; here, 3–5 are common numbers. It attains a height of 60 ft. and has coarsely toothed leaves covered with a thin white felt of stellate hairs on the lower surface. In common with other white felted species it is not attacked by aphids and should be given a trial in the southern counties. *T. maximowicziana* is another aphid free species with leaves white felted below and reaching a height of 100 ft. Good growth has been reported for this species which is very floriferous, the bracts bearing 7–14 strongly perfumed flowers with yellowish petals. It appears

to be quite hardy and might be planted more in parks and avenues where it would have room to develop.

The Mongolian lime is a small rather graceful tree reaching only 30 ft. in height and hence suitable for street planting. The small lustrous leaves with their large triangular teeth give it a distinctive appearance and although smooth, they have not been seen with aphid infestations. Up to 20 flowers are produced to a bract, but even with 5–7 the Kew tree is very floriferous. This appears to be the most promising lime to try as a street tree where space is restricted.

The small leaved lime, *T. cordata*, was a day later than the Mongolian lime and a fortnight after the common lime, starting to flower on June 28. It forms a convenient point of comparison for the later flowering species, next of which, three days later, is the Korean species, *T. insularis* Nakai. The Korean lime is a strikingly beautiful tree when laden with blossom. The flowers are borne on slender pendulous stalks 12 to 36 together, the leaves, which have slender teeth, end in a long cusp and there is often a secondary cusp on the shoulder. The tree is hardy and may reach a height of 60–80 ft., comparable in size with *T. cordata*, but does not seem to be attractive to aphids. It is worthy of widespread trial as an amenity tree.

The hybrid *T. spectabilis* Dippel is a tree of debatable parentage which flowered four days later than *T. cordata*. It is aphid free, but has not otherwise any special qualities to recommend it for extensive planting. *T. oliveri* Szysz. from Central China flowered on the same day. Oliver's lime is a small or medium sized tree reaching 50 ft. high, of rather spreading habit. On this account it is not an ideal street tree though in common with other members of the silver-lime group, in which the leaves are more or less white felted on their lower surfaces, the leaves are not infested by aphids. Oliver's lime has flowered well at Kew and the silver backed leaves make it an attractive tree for park or garden.

Six days after the small leaved lime, *T. euchlora* K. Koch began flowering. This is believed to be a hybrid of *T. cordata* and the Caucasian *T. dasystyla* Stev. For many years *T. euchlora* has been employed on the Continent for street planting, for which purpose it is eminently suited. The deep green glossy leaves remain almost free from aphids in spite of their smooth surfaces. The habit is erect, with the branches slightly pendulous, forming a dense canopy. The fragrant blossoms are borne abundantly, 3 to 7 to a bract and yield a good supply of nectar which is vigorously worked by bees. More extensive planting of this hybrid would be particularly useful as its blossom period begins where that of the common lime ends.

Michaux's lime, *T. heterophylla* Vent. var. *michauxii* (Nutt.) Sarg. is a North American tree which came in flower about 5 days after *T. euchlora*. It grows to 80 ft. in height and has rather large coarsely toothed leaves, which are slightly felted below. Although relatively aphid free, this lime is one of the less desirable sorts on account of its rather coarse appearance and a liability for the branches to die back.

The European White lime, *T. tomentosa* Moench, which began flowering a day later, on July 10, is a handsome tree reaching a height of 100 ft. It has been in cultivation in Britain since 1767, but has never been much planted in spite of its freedom from aphids. The rounded leaves have a

petiole shorter than the blade, which is silvery white below. The flowers are of a dull white colour and borne 3 to 10 on a bract. This species is worthy of more extensive planting.

Next in floral sequence, two days later, was Miquel's lime, *T. miqueliana* Maxim., a rather small tree attaining to 40 ft. It is a native of Eastern China which is much planted about temples in Japan. The leaves are small and neat, though rather coarsely toothed, with the lower surface densely white felted. This appears to keep them free from aphids. The tree is very floriferous, producing 6 to 12 flowers to a bract at Kew, though up to 20 are reported. Added to a small stature, freedom from aphids and an abundance of blossom borne late in the season, is a tendency to hold its leaves late in the year. This combination of characters should make it a most desirable tree for street planting.

The blossom season of the limes finishes with *T. orbicularis* Jouin and the Pendent Silver lime *T. petiolaris* DC. which opened flowers on July 14 and 17 respectively. *T. orbicularis* is reputed to be a hybrid of × *T. euchlora* and *T. petiolaris* ; it is rather less pendulous than the latter and for general planting there is little to choose between the two trees. The pendent silver lime makes a beautiful symmetrical tree with its rounded top reaching a height of 80 ft. The silvery backed leaves remain free from aphids, and the fragrant creamy white flowers are produced in abundance. They are very attractive to bees and many species, in addition to the honey bee, flock to the tree. In spite of their attractiveness, some toxic substance is present in the blossoms, for it is a common sight to see numbers of bees under the trees crawling or kicking their legs in the air in a drunken manner. Many of these die, but almost invariably it is the bumble bees that succumb.

It has been claimed that the nectar of all lime trees is in some degree toxic to bees. The value of limes as bee pasturage and the large amounts of honey obtained from this source are sufficient evidence to prove that the common limes at least are safe sources of nectar. It is probable, therefore, that the nectar is not the source, or at least not the most important source, of the toxin. The habits of the bees themselves may throw some light on this matter. With this point in view, the actions of honey bees while working lime blossom have been closely scrutinised for several years, but never has a bee been observed gathering pollen on limes. I am informed by Dr. C. G. Butler, that in his pollen trapping experiments at Rothamsted not more than 2 or 3 pollen loads of lime pollen have been detected in a season among the many thousands that enter a hive. It appears from these observations that honey bees avoid lime pollen. On the other hand, it is probable that the less specialised bumble bees eat the pollen, which is present in abundance, and succumb to a toxin which it contains. While there appears to be no serious danger to apiculture from the planting of *T. petiolaris*, it is undesirable to kill off any of our beneficial wild bees and the beekeeper would be content if adequate numbers of *T. miqueliana* were planted instead to prolong the nectar season.

Several conclusions may be drawn from this survey of the flowering times of the limes.

1. The three common limes are all early species and *T. platyphyllos* is the earliest of all.
2. The remaining species are on the whole less susceptible or not subject to aphid attack and the honeydew nuisance.

3. There are three trees of moderate size suitable for street planting : early, *T. mongolica* ; midseason, *T. euchlora* and late, *T. miqueliana*. The value of *T. euchlora* has already been proved.

4. There are three trees of larger size, suitable for planting in parks and large gardens, that are recommended for more extensive trial : early, *T. maximowicziana* ; midseason, *T. insularis* and late, *T. tomentosa*.

5. The latest species, *T. petiolaris*, although a beautiful and desirable tree is not recommended for extensive planting on account of its lethal effect on wild bees.

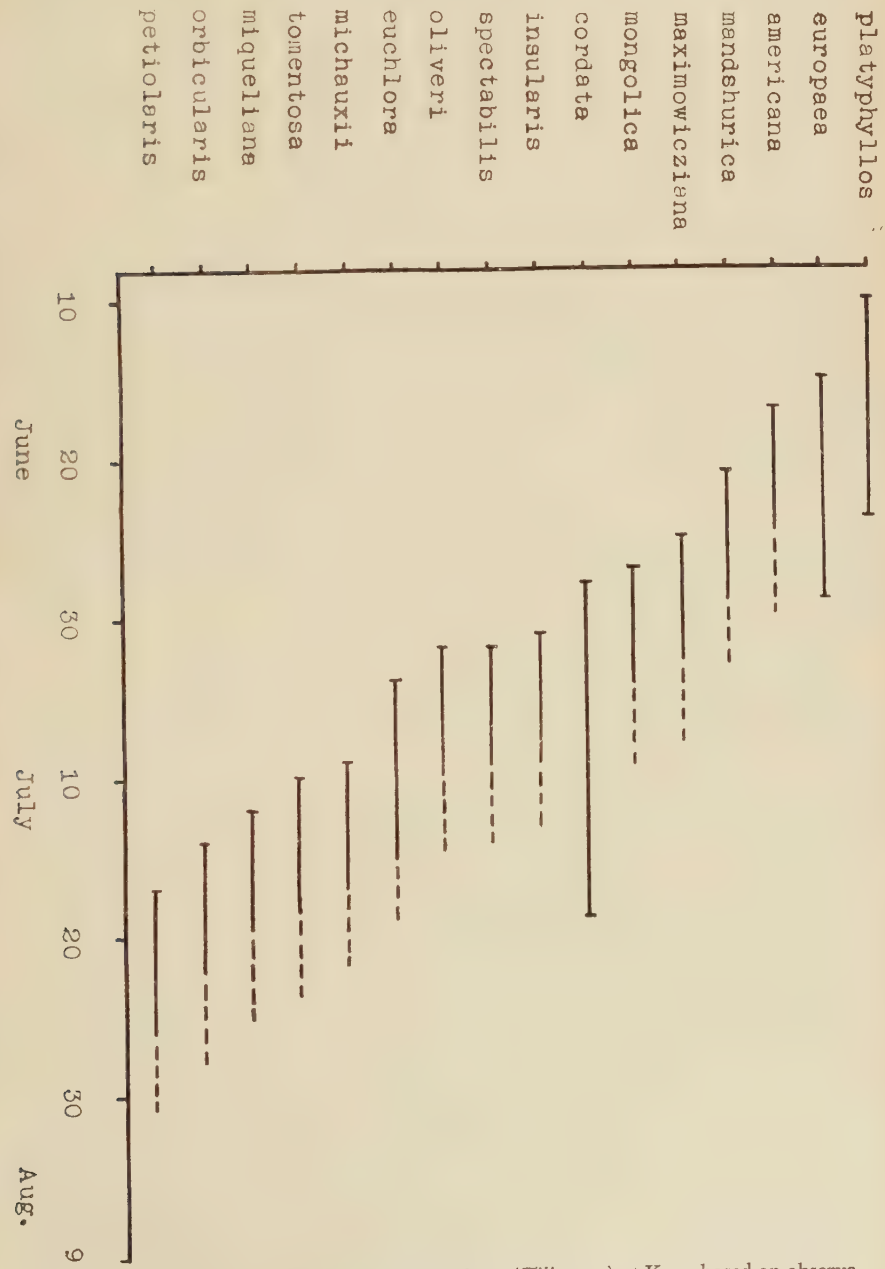


FIG. 1.—Approximate flowering times of the Limes (*Tilia* spp.) at Kew, based on observations made in 1943.

Chydenanthus excelsus (Bl.) Miers (Barringtoniaceae) in Burma and the Andaman Islands.—In the course of an examination of the Indian species of *Barringtonia* recently, the type material of *Barringtonia cymosa* C. E. C. Fischer, described from Tenasserim in 1927, came under notice, and it was immediately evident that this was none other than *Chydenanthus excelsus* (Bl.) Miers, a genus and species hitherto known only from Sumatra and Java. Even more surprising was it to find that R. Knuth, who recently (1939) monographed the family in Engler's *Pflanzenreich* and had borrowed the type of *B. cymosa* from Kew, had failed to notice that this very untypical " Barringtonia " did not belong to the genus, and had enumerated it without comment in the middle of *Barringtonia* Sect. *Doxomma*. One may, incidentally, entertain grave doubts as to whether Knuth's alleged second species of *Chydenanthus*, *Ch. dentato-serratus* R. Knuth, is in fact referable to this genus. The flowers are unknown, and several features (e.g. coarsely serrate leaves, deciduous pedicels) seem quite at variance with *Chydenanthus*.

In the course of looking through the genus *Careya*, two specimens from the Andaman Is. were found, labelled " *Careya valida* Kurz " but obviously having nothing to do with that species (*Planchonia valida* (DC.) Bl.). It did not take long to assign these also to *Chydenanthus excelsus*. These specimens thus represent an important extension of range of this species (and genus), from Sumatra northwards to the Andamans and Lower Burma, and the reduction to synonymy of a thoroughly misplaced alleged species of *Barringtonia*. Synonymy and details of locality are given below.

Chydenanthus excelsus (Bl.) Miers in *Trans. Linn. Soc.* ser. 2, **1,** 112, t. xvii, figs. 15–20 (1875) ; Koord. et Val., Bijdr. No. 6 Kenn. Booms. Java, in *Meded. 's Lands Plantent.* **40,** 20 (1900) ; Backer, *Schoolfl. Java*, 531 (1911) ; Koord. *Exkfl. Java*, **2,** 666 (1912) ; Greves in *Journ. Bot.* **62,** Suppl. (Forbes' Mal. Pl.), 39 (1924) ; Knuth in Engl. et Diels, *Pflanzenr. IV*, **219,** 58, fig. 12 (1939).

Barringtonia excelsa Bl. *Bijdr.* 1097 (1825–26).

Barringtonia cymosa C. E. C. Fischer in *Bull. Misc. Inf.*, Kew, **1927,** 89 (1927) ; Knuth in Engl. et Diels, *Pflanzenr. IV*, **219,** 32 (1939).

Lower Burma. South Tenasserim : near Negya Daung Pass, 180 m., 8 Feb. 1926, *Parkinson* 1682 (type of *B. cymosa*) : " A tree 30–40 feet high. Flowers deep pink". Vernacular name, *le ku maw* (Karen).

Andaman Islands. Without exact locality, April 1914, *Parkinson* 160 : " Evergreen". Havelock Island, Miwala Miq [?], 24 Feb. 1916, *Parkinson* 1046 : " A small tree ".

S.E. Sumatra, C. & E. Java } See authorities quoted under *Chydenanthus excelsus*, above.

H. K. Airy Shaw.

NOTE ON FRUIT SIZE AND VIABILITY IN LITHOSPERMUM OFFICINALE.

E. J. Salisbury and G. H. Preston.

Experiments with various species have shewn that the seeds from depauperate plants may be equally viable to those from vigorous ones and that over a considerable range of vigour as measured by fruit production the effect of diminished nutrition is manifest in output rather than in quality (c.f. E. J. Salisbury, *Reproductive Capacity of Plants* pp. 37–41, 1942). So too it would appear that whilst differences in seed size may be of great importance in respect to the capacity the food reserve confers upon the seedling to endure greater or less severe competition for a longer or shorter period (loc. cit pp. 32 *et seq.*) the seedlings resulting therefrom ultimately produce plants that may not differ in vigour. In general it does not appear that smaller seeds are normally less viable than larger ones but additional evidence in this respect is desirable.

Since it is known that different strains of the same species may differ in the average viability of their seeds it is desirable to test the relation between viability and seed size on propagules obtained from the same individual but the difficulty usually presented is that the range of size on the same individual is often not large.

In the autumn of 1948, however, a specimen of *Lithospermum officinale* was obtained which had produced more than a thousand achenes exhibiting a very wide range in size.

The achenes were sorted out into batches of approximately uniform sizes and the average weight of the respective batches determined as an index of the size of the constituent members of each.

The fact that the proportion of the fruit comprised by the carpellary wall and testa increases as the volume of the fruit diminishes necessarily means that the food supply available in the smallest fruits is appreciably less than the weight alone would imply. So that the gradient in this respect is far steeper than the successive weight groups would suggest.

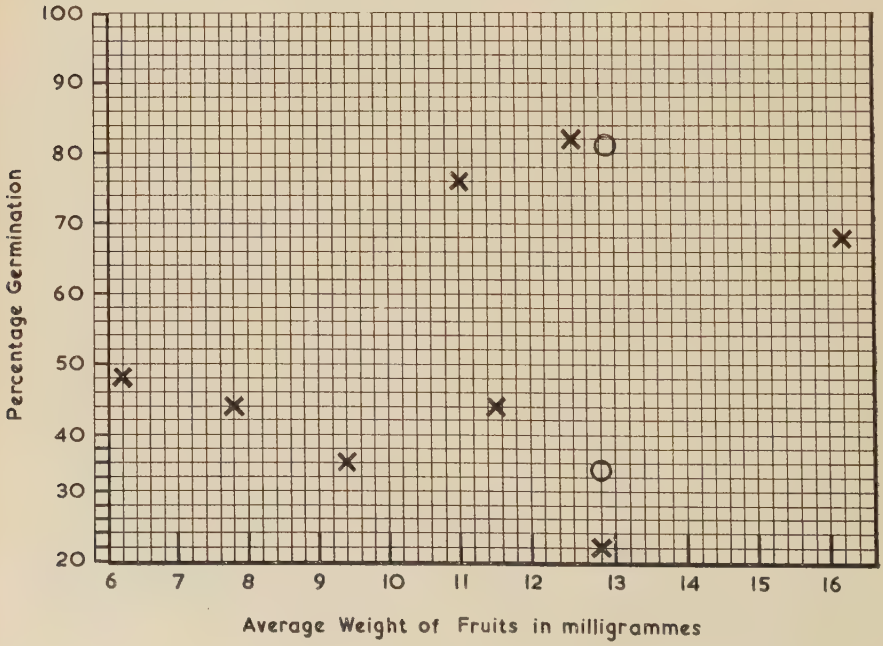
Thus the smallest fruits are rather more than one third the average weight of the largest but the contained food reserves are probably less than one quarter.

The following table shews the average weights of the respective batches and their germination. It may be objected that the fruits of Lithospermum are notorious for exhibiting delayed germination sometimes extending over a period of years and the possibility is not excluded that such differences as are exhibited may be due in part to differences in the proportion of dormant fruits. But it should be stated that the fruits were sown as soon as they were mature and the final counts of germination were not made until one year had elapsed. Moreover two batches of fruits of medium size from the same plant were treated with acid to render the calcareous fruit wall permeable and since these yielded 35% and 81% germination respectively it would suggest that the variations in viability indicated by the untreated fruits were not due to delayed germination.

Untreated

Size	Number	Average Weight	Average Germination	Average of Group
Very small fruits	50	0.0062 gm.	48%	
Small ...	53	0.0078 gm.	44%	Average small
Medium small ...	50	0.0094 gm.	34%	
Medium small ...	50	0.0110 gm.	76%	50% germ.
Medium sized fruits	100	0.0115 gm.	42%	Average medium incl. acid treated 53%
	100	0.0126 gm.	82%	
	100	0.0128 gm.	24%	
Very large fruits	50	0.0162 gm.	68%	
Treated with acid				
Medium ...	100	0.0128 gm.	35%	
	100	0.0131 gm.	81%	

It is obvious that there would appear to be little correlation between fruit size and germination since higher germinations were obtained from both the medium and small sized fruits than for the largest ones. There is no significant difference between the average germination for the small and medium fruits and all one can state is that the smallest fruits have a slightly lower, but possibly not significant, germination which even if valid may but represent a higher proportion of fruits with delayed germination.



The conclusion would then appear warranted that so far as these tests go they are in comformity with experiments on seeds of different sizes as indicating that differences in weight do not represent differences in quality (except with respect to the capacity of the offspring to withstand competition by reason of the greater or smaller food reserves). Such differences in size and weight are perhaps of greatest significance as conferring an increased range of dispersal and diminished risk of competition between the offspring derived from a particular parent individual.

ADDITIONAL NOTES ON THE FLORA AND VEGETATION OF THE ATHOS PENINSULA, GREECE.

W. B. Turrill.

The writer has recently received from Dr. C. N. Goulimy of Athens some specimens of plants collected on the Athos Peninsula, between 31 July and 8 August 1947. As there are several additions to the list published in *Kew Bull.* 1937 : 197–272, this short account has been prepared.

Delphinium fissum W. et K. var. *pubescens* Heuff. Ravine over Strati.

Geranium striatum L. Moni Philotheou.

Circaea lutetiana L. Moni Philotheou.

Epilobium angustifolium L. Ravine over Strati.

E. obscurum Schreb. Moni Philotheou.

Campanula athoa Boiss. et Heldr. Karyai (Karyes) to Moni Koytloumousiou (Koutloumousiou).

C. persicifolia L. Karyai to Moni Koythoumousiou.

Diosphaera rumeliana (Hampe) Bornm. Ravine over Strati. A variant with most of the leaves more or less oblanceolate.

Vaccinium myrtillus L. Ravine over Strati.

Physalis alkekengi L. Moni Katakal(l)ou.

Linaria genistifolia Mill. Moni Hag. Paulou (St. Paul).

Calamintha nepeta (L.) Savi sensu Hayek.

Orchis macrostachys Tin. Ravine over Strati.

In addition Dr. Goulimy sent some material of *Orchis iberica* M. Bieb. from Chelmos (Aroania), collected on 1 Aug. 1946, at Varko, close to Vrisei Pelekenou about 6–7 km. south of Mira Spilaeon Monastery.

A letter from Dr. Goulimy, dated 18 Jan. 1949, contains some recent information regarding the vegetation of the Athos Peninsula. It is important that some of the facts given in this letter should be placed on permanent record and the following paragraphs are therefore published.

" You will be sorry to hear that I found on my above mentioned visit to the Athos peninsula last year that some thousands of acres of forest land had been destroyed by fire, mostly on the eastern side. The

destruction was of recent date and was attributed by some to the guerillas and by others to the local gendarmerie who had cleared the ground as a protection against surprise attacks.

" But what is still worse is that the laws prohibiting the grazing of goats, sheep and cattle, etc., in the Athos area have been violated by the police authorities of Chalkidiki who, much against the protests of the monasteries, have permitted the shepherds to bring into the Athos area their flocks. This was done in April 1947, that is to say a few months before my arrival. I was told that as a result of this permission over 30,000 goats, sheep and cattle had invaded this area. I am not of course in a position to check this figure but I can affirm that most of the places I visited showed very strongly the marks of the destruction caused by grazing. It is for this reason that I was compelled to abandon my original plan of ascending mount Athos as I was informed from many sources that the vegetation of the higher zones of the mountain which are bare of trees, had been completely destroyed by the invaders. The only place which I found comparatively unspoiled was the above mentioned ravine overlooking Strati. Although Strati itself was infested by sheep and goats the ravine had not yet been invaded as large masses of snow (in some places over 6 feet deep) had prevented the shepherds from taking their flocks there.

" When I returned from mount Athos to Athens I approached several persons, including one Cabinet minister, some of the newspapers, the society for the protection of forests, informed them of the danger and asked for their assistance to save this precious botanical heirloom. These efforts, however, were not successful. I am wondering whether the Government would pay more attention to the matter if an appeal was made from outside, such as botanical institutes, universities, etc."

Seventh International Botanical Congress, Stockholm 1950.

The Seventh International Botanical Congress will be held in Stockholm between July 12 and 20, 1950. Presessional excursions will start on June 27 and postsessional will end on August 9. Communication No. 2 from the Organizing Committee containing the preliminary outline of the programme, during the meetings and the preliminary plans for the excursions, can be obtained from the Secretary General, Dr. Ewert Åberg, Uppsala 7, Sweden.

ADDITIONS TO THE FLORA OF BORNEO AND OTHER MALAY ISLANDS: XXI*.

THE OXFORD UNIVERSITY EXPEDITION TO SARAWAK, 1932: FLACOURTIACEAE, TILIACEAE, STERCULIACEAE, ELAEOCARPACEAE, AND OTHER SMALLER GROUPS.

H. K. AIRY SHAW.

FLACOURTIACEAE

Hydnocarpus (§**Asteriastigma**) **lasionema** *Airy-Shaw*, sp. nov., ab *H. macrocarpo* (Bedd.) Warb., cui valde affinis, foliis subtus magis lucentibus, venulis paullo validioribus, indumento partium iuniorum minutissime et subtilissime tomentello (nec fasciculato-pubescente), floris masculi petalis oblanceolatis vel obovatis sesquies usque plus duplo longioribus dorso dense et longe aureo-sericeis, filamentis longe aureo-pilosis bene distincta.

Arbor usque 50 m. alta. *Rami hornotini* 5–15 cm. longi, 2–4 mm. crassi, striati, minutissime et subtilissime ferrugineo-tomentelli (pilis singulis sub lente haud cernendis) ; *annotini* et vetustiores validi, 3–8 mm. crassi, cortice laevi vel longitudinaliter striato vel varie (praecipue transverse) fisso, cinereo- vel brunneo-fusco. *Folia* iis *H. macrocarpi* simillima : hornotina oblonga, oblongo-elliptica, vel leviter oblanceolata, 10–23 cm. longa, 5–9 cm. lata, basi (saepe inaequali) rotundata usque subcuneata, rarius subcordata, apice abrupte breviter caudato-acuminata (cauda circiter 1 cm. longa et 1–2 mm. lata), integerrima, coriacea, siccitate atro- vel cinereo-fusca, supra glaberrima, obscura, infra pilis minutissimis fasciculatis (? stellatis) crebriusculis nec tamen contiguis conspersa, nitida, epidermi minutissime puncticulato ; costa valida, supra prominula vel vix impressa, infra valde prominens ; nervi primarii laterales utrinque 5–8, supra prominuli, infra valde prominentes, primum suberecti, dein longissime arcuati ; et costa et nervi primarii densiuscule et minute fasciculato- (? stellato-) tomentelli ; nervi secundarii inter primarios scalariformiter dispositi, nervo validiore cum tenuiore plerumque alternante, cum nervulis ultimis reticulum conspicuum pulchrum utraque pagina (maxime infra) prominulum efficientes, quam in *H. macrocarpo* paullo validiores nec ita argute prominuli ; petioli graciliusculi, 2–3 cm. longi, 1–2 mm. crassi, eodem modo ut ramuli ferrugineo-tomentelli, subtiliter striati. *Folia annotina* et vetustiora subtus vix nitida, petiolis saepe incrassatis et transverse rugoso-fissis. *Inflorescentiae* axillares vel ut videtur interdum extra-axillares (folio suffulciente suppresso?), cymoso-paniculatae, ferrugineo-tomentellae, striatae, pedunculis brevissimis 2–4 mm. longis ad apicem ramulorum saepe subfasciculatis, sub ima basi pedicellorum subito subdisciformiter incrassatis, pedicellis gracilibus 1–2·5 cm. longis basi cum pedunculis articulatis. *Alabastra* ♂ globosa, 7–9 mm. diametro. *Flores* ♂ expansi circiter 2.5 cm. diametro. *Sepala* 4 (–6) : exteriora 2 suborbicularia, valde cucullata, 1–1·5 cm. diametro, extra minutissime fasciculato-stellulato-tomentella, intus glabra ; interiora 2 (–4) late ovata, circiter 8 mm. longa, 5–6 mm. lata, dorso praecipue secus lineam mediam sparsiuscule tomentella, marginem

*Continued from *K.B.* **1949,** 125.

versus et intus glabrescentia ; dum sepala 6 adsint, intima 2 subpetaloidea (sed squama destituta), dorso secus lineam mediam pilis longis sericeis aureis praedita, sicut petala vera. *Petala* 11–13, plerumque 12, interiora anguste oblanceolata, 10 mm. longa et 2–3 mm. lata, gradatim in exteriora obovata vel late obovata vel suboblonga usque 1·5 cm. longa et 8–9 mm. lata transeuntia, omnia apice rotundata, dorso longe densissime adpresse aureo-sericea, margine longe ciliata, intus glabra ; squamae obovato-cuneatae, 2–3-lobae, crassae, 3–5 mm. longae, densissime longe aureo-sericeae. *Stamina* circiter 50 : filamenta 6–9 mm. longa, angustissime lineari-subulata, applanata, longe aureo-pilosa, apice glabrescentia ; antherae oblongo-ellipticae, 3–4 mm. longae, 0·8–1·5 mm. latae, connectivo latiusculo, basi cordatae, apice minute apiculatae. *Ovarii* vestigium nullum. *Flores feminei* ignoti.

Dulit, primary rain-forest on crest of steep-sided ridge, under 300 m., 16 Aug., *Richards* 1296 (type): " Tree, timber-class ' B '. Height prob. *c.* 160 ft. [48 m.]. Diam. at breast-height 23 in. [60 cm.]. Buttresses small, varying in angle. Bark smooth, $\frac{1}{4}$ in. [6 mm.] thick, scaling off in small irregular pieces. Used in native house-building."

Also :—

British North Borneo. Commercial forest, Montanior, Beaufort, 12 Sept. 1932, *Melegrito* in *B.N.B. For. Dept.* 2530 : " Timber tree species, 35 ft. [10·5 m.] high. Fruit green."

This interesting plant might well be regarded as a third subspecies of *H. macrocarpus** (*vide* Sleumer in Engl. *Bot. Jahrb.* **69,** 28 : 1938), but, though the foliage is so similar, the pubescent petals and filaments seem to warrant its being treated as a distinct species. *H. macrocarpus* is now known from Burma (ssp. *burmanicus** Sleumer) in addition to its original S. Indian locality (ssp. *malabaricus** Sleumer) (see Fischer in *Kew Bull.* **1927,** 98 : 1927), and the discovery of *H. lasionema* extends the range of the group *Asteriostigma* very considerably eastwards. *H. anomala* (Merr.) Sleumer appears to be rather closely allied.

Hydnocarpus borneënsis Sleumer in Engl. *Bot. Jahrb.* **69** (1), 52 (1938).

Dulit, primary forest on side of ridge, under 300 m., 25 Oct., *Richards* 2327 : " Tree, *c.* 4 m. high. Fl. greenish white."

Differs from the type in the almost symmetrical leaf-bases, but otherwise agrees satisfactorily.

Ryparosa hullettii King in *Journ. As. Soc. Beng.* **59** (2), 126 (1890), (*Mat. Fl. Mal. Penins.* no. 2, 66) ; Ridl. *Fl. Mal. Penins.* **1,** 165 (1922) ; *var.*

Dulit, secondary forest, under 300 m., 28 Oct., *Native Collector* for *Richards* 2352 : " Tree, *c.* 4 m. high. Fls. greenish white."

Differs from the type in Herb. Kew. in the less cuneate leaf-bases, 4–5 (instead of 3) pairs of lateral nerves, and slightly smaller male flowers with shorter staminal column.

*Sleumer writes *H. macrocarpa*, ssp. *burmanica* and ssp. *malabarica*, but it is now agreed to treat all modern compounds ending in *-carpus* as masculine ; see Art. 72 (2) (now a recommendation).

TILIACEAE

Microcos hirsuta (Korth.) Burret in *Notizbl. Bot. Gart. Berlin*, **9**, 734, 782 (1926).

Omphacarpus hirsutus Korth. in Temm. *Verh. Nat. Gesch. Ned. Overz. Bezitt.*, Bot., 193 (1839–42).

Grewia omphacarpa Miq. *Fl. Ind. Bat.* **1** (2), 204 (1858–9) ; Merr., Bibl. Enum. Born. Pl., in *Journ. Str. Br. Roy. As. Soc.* **1921,** spec. no., 373 (1921).

Dulit, secondary forest on hill ridge, *c.* 300 m., 5 Aug., *Richards* 1129 : 1129 : " Shrub, under 5 m. Petals white ; stamens bright yellow."

Microcos (§**Eumicrocos**) **dulitensis** *Airy Shaw*, sp. nov., *M. fibrocarpae* (Mast.) Burr. atque *M. hirsutae* (Korth.) Burr. affinis, ab illa foliis subtus sparse (nec dense) pubescentibus, sepalis extra minute dense tomentellis (nec longe velutinis), ab hac foliis plerumque maioribus crassioribus bullatis basi leviter cordatis apice breviter obtuse cuspidatis distincta.

Arbor, c. 8 m. alta ; ramuli validi, annotini et vetustiores usque 7 mm. diametro, teretes, cortice ± cinereo longitudinaliter reticulato-striato cito glabrescente, hornotini 2–3 mm. diametro, dense breviter sordide fulvo-velutini (sed minus dense ac in *M. fibrocarpa*). *Folia* elliptico-oblonga usque leviter obovato-oblonga, 8–23 cm. longa, 5–9 cm. lata, basi inaequilateralia usque fere aequilateralia, leviter sed distincte cordata, rarius rotundata, apice breviter obtuse cuspidata (cuspide circiter 1 cm. longa), margine integro inconspicue subsinuato, supra (costa inferne tomentella excepta) glabra, siccitate griseo-viridia, subtus secus nervos venulasque sparse patule fasciculato-pubescentia, secus costam fere tomentosa, siccitate brunnescentia, rigide chartaceo-coriacea, ± bullata ; nervi laterales (basalibus inclusis) 5–8-iugi, supra ± bullato-impressi sed haud insculpti, subtus valde prominentes, basales ab ima basi costae subito orti, subrecti vel leviter curvati, saltem usque ad dimidiam laminam attingentes, nervos secundarios numerosos marginem versus procurvos et anastomosantes edentes, nervi secundarii inter primarios scalariformiter dispositi, tertiarii angulo recto ex his exorti, omnes reticulum elevatum valde conspicuum efformantes ; petioli 1·2–1·5 (raro usque 1·8) cm. longi, sicut ramuli induti. *Thyrsi* axillares et pseudo-terminales, 2–6 cm. longi, breviter fulvo-velutini, triadum pedunculis 5–8 mm. longis. *Pedicelli* 2 mm. longi, dense tomentelli, siccitate rosei. *Bracteae* et *bracteolae* (" folia floralia ") 3+3, exteriores late obovatae, 4–5 mm. longae, 3–4 mm. latae, interiores anguste oblongae vel oblanceolatae, 3–4 mm. longae, 1·5 mm. latae, omnes dense tomentellae, siccitate roseae, ante anthesin caducae. *Pedicelli* 2–3 mm. longi, dense tomentelli. *Sepala* oblonga usque oblanceolata, 6–7 mm. longa, 2–3 mm. lata, induplicato-valvata, uti bracteae (sed intus minus dense) indutae, albae, siccitate roseae. *Petala* nulla. *Discus* 5-lobus, humilis, longe ciliatus. *Stamina* 30–35, filamentis filiformibus 3–4 mm. longis, antheris minimis subglobosis. *Ovarium* subglobosum, 1·5 mm. diametro, tomentellum, 3-locularis, loculis 4-ovulatis, ovulis 2-seriatis angulo interno affixis. *Stylus* simplex, 3–4 mm. longus, glaber, stigmate punctiformi. *Fructus* ignotus.

Dulit Ridge, ' transition ' forest at foot of cliff, *c.* 1300 m., 13 Sept., *Richards* 1767 : " Tree, c. 8 m. high. Petals [*sic*] white, anthers bright yellow. Leaves very thick and hard."

In the *Omphacarpus* group of Sect. *Eumicrocos* Burret, this species is distinguished by its large stiff leaves, glabrous to the unaided eye, with exceedingly prominent, somewhat bullate nervation below, and by its tomentellous flowers drying pinkish as in *M. erythrocarpa* (Ridley) Airy Shaw*.

Pentace sp.

Dulit, secondary forest, under 300 m., 13 Aug., *Richards* 1242 : " Tree, 96 ft. [29 m.] high. Diam. 15 in. at 6 ft. from ground. Buttresses small. Bark $\frac{3}{4}$ in. thick, smooth, reddish, with small longitudinal fissures. Wood reddish with marked rings."

This apparently represents an undescribed species, near *P. laxiflora* Merr., but with a very much more minute indumentum than that species. The material is in young bud, too immature to serve as the basis of a description.

Sterculiaceae

Pterospermum stapfianum Ridley in *Bull. Misc. Inform.*, Kew, **1933,** 489 (1933).

Dulit, secondary forest on river bank, under 300 m., 15 Oct., *Native Collector* for *Richards* 2225 : " Small tree. Corolla greenish white (in bud). Leaves white beneath, except along veins, which are brown."

Dulit, secondary forest, river bank, under 300 m., 28 Oct., *Richards* 2354 : " Tree about 10 m. high, but does grow to larger sizes. Petals white. Sepals light brown externally. Fls. with sickly scent. Timber, Class 1 (c). Bark used for making *praus* [native canoes]."

Vernacular names : *baior* (Sar. Malay), *kedan* (Keniah).

Leptonychia heteroclita (Roxb.) Kurz in *Journ. As. Soc. Beng.* **39,** II, 67 (1870) ; Merr. *Bibl. Enum.* 378 (1921).

Grewia heteroclita Roxb. *Fl. Ind.* (ed. Carey), **2,** 590 (1832).

Leptonychia glabra Turch. in *Bull. Soc. Imp. Nat. Mosc.* **31,** II, 223 (1858) ; Ridl. *Fl. Mal. Pen.* **1,** 289 (1922).

Dulit, secondary forest by stream, under 300 m., 12 Aug., *Richards* 1214 : " Small tree, c. 2 m. high. Fls. greenish white."

Dulit, stony rain-forest near torrent, under 300 m., 14 Aug., *Native Collector* for *Richards* 1254 : " Shrub, flowers pale green."

Dulit, primary river-bank forest, under 300 m., 20 Aug., *Richards* 1363 : " Shrub, under 2 m. high. Fls. white."

Sterculia burbidgei Stapf ex Ridley in *Bull. Misc. Inform.*, Kew, **1933,** 488 (1933).

***Microcos erythrocarpa** (*Ridley*) *Airy Shaw*, comb. nov.—*Grewia erythrocarpa* Ridley in *Journ. Str. Br. Roy. As. Soc.* **1920** (2), no. 82, 174 (1920) et *Fl. Mal. Penins*, **1,** 301 (1922) ; Burret in *Notizbl. Bot. Gart. Berl.* **9,** 731 (1926).

Dulit, rain-forest, under 30 m., 31 July, *Native Collector* for *Richards* 1048 : " Tree, c. 3 m. Fls. yellowish, proximal part tinged with dull red. Leaves somewhat chartaceous."

Dulit, rain-forest, under 300 m., 2 Aug., *Synge* 1079 : " Small tree."

Doubtfully distinct from *S. trichopetiolata* Merr. The latter has, however, considerably shorter calyx-segments.

Sterculia membranacea Merr. in *Philipp. Journ. Sci.* **21,** 527 (1922).

Dulit Trail, primary forest on steep open spur of mountain, *c.* 500 m., 25 Aug., *Native Collector* for *Richards* 1451 : " Small tree. Petals [*sic*] white, joined at the apex."

Dulit, primary forest, under 300 m., 18 Oct., *Native Collector* for *Richards* 2267 : " 2 m. high. Corolla [*sic*] white, petals [*sic*] joined by apices. Fl. stalks red." Vernacular name : *ringin.*

No. 2267 differs from the type in the rounded, not (or scarcely) cuneate leaf-bases, and in the somewhat fewer lateral nerves which are not (or scarcely) elevated on the upper surface, but it agrees very well in other respects.

Sterculia elliptica *Airy Shaw*, sp. nov., inter species *S. rubiginosae* Vent. affines, *S. oboratae* Merr. proxima, a qua foliis paullo maioribus plerumque ellipticis vel oblongis longe acutissime caudatis basi magis cuneatis sub lente distinctius reticulatis, thyrsis paucioribus longioribus, distincta.

Arbor 11 m. alta ; ramuli usque 5 mm. diametro, vetustiores cinerei, parce pubescentes vel glabrescentes, iuniores fusco-tomentosi. *Folia* elliptica, rarius fere oblonga vel obovata, 12–19 cm. longa, 3–7·5 cm. lata, basi late cuneata usque subrotundata, apice abruptiuscule longe tenuiter caudata, cauda 2–3·5 cm. longa 2–3 mm. lata acutissima, margine integro fere plano, supra (costa excepta) glabra, nitidula, subtus (costa nervisque exceptis) glabra, obscuriora, utrinque siccitate olivacea, chartacea ; costa supra impressa, fusco-tomentosa, subtus prominens, sparse stellato-pubescens ; nervi laterales 9–11-iugi, supra fere bullato-impressi, subtus valde prominentes, late patuli, sursum arcuati, prope marginem anastomosantes, 2 basales margini paralleli, sparse stellato-pubescentes ; nervi secundarii reticulum laxum efformantes, valde dissite stellato-pilosi, venulis ultimis sub lente reticulum pulchrum creberrimum efformantibus ; petioli 1·2–2·5 cm. longi, satis robusti, apice conspicue pulvinati, fusco-tomentosi ; stipulae anguste subulatae, 5–8 mm. longae, acutae, fusco-tomentosae. *Thyrsi* terminales, 2–3 e quoque ramulo, 10–15 cm. longi, graciles, fusco-brunneo-tomentosi, ramulis gracillimis 1–2 cm. longis patentibus 1–4-floris, pedicellis 5–10 mm. longis. *Calyx* sub anthesin 1–1·5 cm. diametro; segmenta anguste ovata, caudato-acuminata, primum apice connata, demum libera, late patentia, extra breviter stellato-pubescentia, intus (basi glabra excepta) et marginibus longe dense hirsuta, alba, parte glabra macula sanguinea notata. *Androgynophorum* (vel androphorum) 1–1·5 mm. longum, glabrum, curvatum. *Androecium* globosum, glabrum. *Ovarium* ovoideum, 2 mm. longum, 1·5 mm. latum, dense tomentosum, stylo brevissimo recurvo, stigmate capitato glabro. *Fructus* ignotus.

Gunong Balapau, Ulu Tinjar, rain forest on crest of high ridge, c. 600-800 m., 2 Nov., *Richards* 2401 : " Tree 11 m. high. Petals [*sic*] white, with oval crimson patch at base internally ; apices joined in the young flower, but widely spreading when mature."

In the polymorphic *rubiginosa* group, evidently very closely allied to *S. obovata* Merr., but sufficiently distinct in the larger, elliptic leaves with long drip-tip, taken in conjunction with the other smaller differences noted in the diagnosis. The general leaf-outline and slender inflorescences resemble those of *S. rhynchophylla* K. Schum., but the more oblong-elliptic shape, laxer nervation, longer glabrous petioles, and different indumentum of the lower surface of the discolorous leaves, in the latter species, indicate a less close affinity.

Celastraceae

Lophopetalum beccarii Pierre, *Fl. For. Cochinch.* **4,** fasc. 20, sub t. 307 (1894) ; Merr. *Bibl. Enum.* 354 (1921).

Dulit, primary forest on crest of ridge, under 300 m., 4 Nov., *Richards* 2399 : " Tree, 25 m. high, 23 cm. diam. Traces only of buttresses. Calyx pale green, corolla yellow."

Vernacular name : *medang.*

Kurrimia paniculata (Arn.) Wall. ex Lawson in Hook. fil. *Fl. Brit. Ind.* **1,** 622 (1875) ; Merr. *Bibl. Enum.* 354 (1921) ; Ridl. in *Kew Bull.* **1938,** 235 (1938).

Bhesa paniculata Arn. in *Edinb. New Philos. Journ.* **16,** 315 (1834).

Dulit, primary forest on side of steep ridge, under 300 m., 12 Aug., *Richards* 1224: " Tree, 74 ft. [22 m.] high, first branch at 33 ft., diam. 3 ft. from ground 11 in. No buttresses. Bark $\frac{3}{8}$ in. thick, smooth, reddish. Wood somewhat reddish." Vernacular name : *kayu minyak.*

Dulit Trail, forest on edge of torrent, under 300 m., 26 Aug., *Richards* 1457 : " Tree, 13 in. diam. Fls. and infl. axes creamy white." Vernacular name : *resak sabut.*

Dulit Trail, primary forest on steep slope of mountain, *c.* 600 m., 27 Aug., *Richards* 1488 : " Tree, diam. 28 cm. Fls. creamy white." Vernacular name : *resak sabut.*

Dulit, secondary forest on river bank, under 300 m., 15 Oct., *Richards* 2226 : " Tree, *c.* 4 m. high. Fls. creamy white, fruit crimson. Inflorescence axis becoming crimson as fruit ripens." Vernacular name : *resak buntun.*

Leeaceae

Leea aculeata Bl. *Bijdr.* 197 (1825) ; Merr. *Bibl. Enum.* 368 (1921).

Dulit Ridge, second growth, under 300 m., 4 Oct., *B. M. Hobby* for *Richards* 2125 : " Petals white, sepals green. Weak straggling tree."

Vitaceae

Cissus cf. **rostrata** (Miq.) Korth. ex Planch. in DC. *Mon. Phanerog.* **5,** 500 (1887) ; Merr. *Bibl. Enum.* 368 (1921).

Vitis rostrata Miq. in *Ann. Mus. Bot. Lugd.-Bat.* **1,** 85 (1863-4).

Dulit, primary(?) rocky forest by torrent, under 300 m., 30 Sept., *Richards* 2088 : "Apparently fragment of a large liane fallen from canopy. Petals greenish white."

ELAEOCARPACEAE

Elaeocarpus multinervosus R. Knuth in Fedde, *Rep. Spec. Nov.* **44,** 130 (30 June 1938).

Elaeocarpus polycarpus Stapf ex Ridley in *Bull. Misc. Inform.*, Kew, **1938,** 230 (15 Aug. 1938), **syn. nov.**

Ulu Koyan, growing by bank of river in sand forest, *c.* 800 m., 16 Sept., *Synge* 490 : "Small tree, *c.* 40 ft. high. Circumference 1 ft. Calyx and corolla yellowish buff."

Only the female flowers of this species are so far known. Ridley has somewhat exaggerated the number of "stamens" (staminodes). The abnormal type of inflorescence to which he refers is evidently the "floriparous diaphysis" mentioned by Penzig, *Pflanzenteratol.* ed. 2, **2,** 172 (1921).

Elaeocarpus clementis Merr. in *Journ. Str. Br. Roy. As. Soc.* **1917** (3), no. 77, 195 (1917), var. **chrysoserica** *Airy Shaw*, var. nov. inflorescentiis (praecipue pedicellis sepalis petalis) adpresse aureo-sericeis.

Dulit Trail, primary forest on spur of mountain, *c.* 600 m., 27 Aug., *Richards* 1489 (typus) : "Tree, 10 m. high, 23 cm. diam. Fls. pale yellowish brown, sweet-scented." Vernacular name : *morang kuning.*

Dulit Trail, rain-forest on steep slope, 700–900 m., 19 Sept., *Native Collectors* for *Richards* 1908 : "Tree, 6 m. high. Fl. buds greenish yellow." Vernacular name : *lansi bukit.*

There is here a complex of closely allied forms. The following have received names : *E. polystachyus* Wall. ; *E. integripetalus* Miq. (not seen) ; *E. clementis* and *E. cupreus* Merr. ; *E. multinervosus*, *E. canipes*, *E. fagaceus* and *E. clemensiae* R. Knuth ; *E. ochraceus* and *E. polycarpus* Stapf ex Ridley ; *E. polyanthus* and *E. polystachyus* var. *borneënsis* Ridley. The first two, described from Singapore and Sumatra respectively, are tetramerous ; the remainder, all Bornean, are pentamerous. Of these, *E. multinervosus* (syn. *E. polycarpus*) may be recognized by its large leaves and dense, almost lanuginose tomentum ; *E. canipes* (syn. *E. polystachyus* var. *borneënsis*) by its tomentose but not lanuginose inflorescence, and rather densely puberulous leaf-undersurface ; *E. polyanthus* by its very large flowers and somewhat oblanceolate leaves and lax venation ; *E. cupreus* by its small leaves, drying coppery below, and its short racemes of small flowers. The remainder are extremely close to each other and more material is required in order to determine their status, but for the present I regard at least *E. clemensiae* and *E. ochraceus* as forms of *E. clementis*. *E. fagaceus* is somewhat intermediate between the latter and *E. cupreus*.

Haviland 2230, cited by Ridley under *E. ochraceus*, is referable to *E. cupreus* Merr. *Beccari* 3786 and *Mendoza* in *Brit. N. Borneo For. Dept.* 4290 represent forms of *E. clementis*.

The above group, which may be referred to provisionally as the "*Polystachyus* group," seems to be most closely related to the first five

species of " Section C " of the " Pentamerous group " referred to by Corner in *Gard. Bull. Str. Settlem.* **10,** 310 (1939). It differs principally in the fine close parallel tertiary nervation and in the globose or subglobose, scarcely pointed, flower-buds.

Elaeocarpus sordidus *Airy Shaw*, sp. nov., ex aff. *E. proceri* A. DC. (*E. fusicarpi* Elm., synon. nov.*) et *E. lasionychis* Stapf ex Ridley, a priore foliis obscurissime crenulatis (primo adspectu integris), ab utroque foliis glaberrimis (nisi supra secus costam) siccitate sordide fusco-brunneis (nec subcastaneis) minute pustulatis recedit.

Arbor, 10–20 m. alta. *Ramuli* graciles, parum ramosi, usque 4 mm. crassi, teretes, cortice fusco laevi sub lente minute puberulo sparse vel densiuscule albo-lenticellato, lenticellis parvis rotundatis, innovationibus fulvido-cinereo-tomentellis. *Folia* elliptica, rarius leviter lanceolato- vel oblongo-elliptica, 4·5 8·0 cm. longa, 1·5–2·7 cm. lata, basi rotundata usque late cuneata, margine obscurissime crenulata velut subintegra, apice breviter subcaudata, ipsa cauda obtusa, costa supra (interdum subtus) excepta glaberrima, siccitate tenuiter chartacea, sordide fusco-brunnea, minute crebre albido-pustulata (more *E. floribundi* Bl. sed haud ita conspicue) ; costa gracilis, subtus elevata interdum sparse minutissime puberula, supra prominula minute puberula ; nervi laterales circiter 8-jugi, graciles, late patuli, arcuato-procurvi, marginem versus anastomosantes ; petioli graciles, 3–7 mm. longi, densiuscule cinereo-puberuli. *Racemi* numerosi, axillares, folio suffulciente breviores, 2–5 cm. longi, 5–12-flori, patuli, graciles, rhachi pedicellisque cinereo-fulvido-tomentellis vel -puberulis, pedicellis gracillimis 3–5 mm. longis. *Flores* parvi, pentameri. *Sepala* lanceolata, 4–5 mm. longa, 1–1·5 mm. lata, acuminata, acuta, margine dense fulvido-cinereo-tomentella, dorso sparse minute puberula, intus glabra. *Petala* cuneato-obovata, 4–5 mm. longa, circiter 1·5 mm. lata, usque ad medium in lacinias circiter 10 divisa, alba vel pallide lutescentia, inferne extus et intra longe aureo-sericeo-barbata. *Stamina* 2 mm. longa (filamento 0·5 mm., anthera 1·5 mm.), antheris minute adpresse puberulis thecis apice longiuscule penicillatis (exteriore magis quam interiore) ; glandulae torusque valde pubescentia. *Pistillum* 5–6 mm. longum : ovarium conicum, dense sericeo-tomentosum, 3-loculare ; stylus inferne sericeus, superne glaber. *Fructus* completus ignotus, sed endocarpio (e specim. Amdjahii) fusiformi 3·3 cm. longo 8 mm. diam. acuminato parce dissite verruculoso.

Dulit, rocky valley of small stream, primary forest, under 300 m., 22 Aug., *Richards* 1387 (typus) : " Tree, 70 ft. [21 m.] high. Diam. 22 in. [0.55 m.]. Buttresses small, some reddish in section, 1·2 cm. thick. Wood pinkish. Petals white. Timber useful." Vernacular name : *medang pari*.

Sungei Balapau, Ulu Tinjar, bank of stream, secondary forest, under 300 m., 3 Feb., *Richards* 2413 : " Tree, *c.* 10 m. high. Petals pale yellowish."

Also :—
Dutch Borneo. Tikoeng, Nov. 1912, *Amdjah* 906.

*Cf. p. 165, *infra*.

Elaeocarpus pedunculatus Wall. ex Mast. in Hook. fil. *Fl. Brit. Ind.* **1,** 408 (1874) ; Merr. *Bibl. Enum.* 371 (1921).

Ulu Koyan, white sand forest, *c.* 900 m., 16 Sept., *Synge* 1871 : " Tree 17 m. high, 23 cm. diam. No buttresses. Calyx buff. Petals white."

Elaeocarpus brevipes Merr. in *Journ. Str. Br. Roy. As. Soc.* **1922** (2), no. 86, 327 (1922).

E. baramensis R. Knuth in Fedde, *Rep. Spec. Nov.* **44,** 126 (1938), **syn. nov.**

E. rejangensis R. Knuth, *l.c.*, **syn. nov.**

Dulit, bank of small river, under 300 m., 13 Aug., *Native Collector* for *Richards* 1245 : " Tree, *c.* 13 ft. high."

Sungei Balapau, Ulu Tinjar, river bank, under 300 m., 18 Nov., *Richards* 2629 : " Tree, *c.* 7 m. high."

Vernacular name : *pungo.*

Elaeocarpus glaber Bl. *Bijdr.* 122 (1825) ; Ridl. in *Kew Bull.* **1938,** 234 (1938) ; *var.*

Dulit, bank of small river, secondary forest, under 300 m., 14 Oct., *Richards* 2209 : " Tree, about 8 m. high, but over 30 cm. diam. Fls. with faint sickly scent, sepals greenish white, petals white, fringed. Stigma reddish. Glands (?) round ovary brown. Numerous trees in flower on this date."

This differs from typical *glaber* (which has not hitherto been noted from Borneo) in its narrower and more shortly petiolate leaves. *E. sphaeroblastus* Stapf ex Ridley is very similar, but has unusually small flowers with ovate sepals. Pending a revision of the whole group it seems best to refer these forms to the aggregate species, which may also include *E. subpuberus* Miq. (Sumatra) and *E. hosei* Merr. (Sarawak).

Elaeocarpus obtusus Bl. *Bijdr.* 123 (1825).

Dulit Trail, stony primary forest in valley, under 300 m., 10 Aug., *Richards* 1189 : " Tree, *c.* 90 ft. high. Circumference 5 ft. from ground, 6 ft. 2 in. Buttresses numerous, spreading with concave outline. Bark smooth, granular with numerous lenticels. Wood white, very hard. Petals white, fls. heliotrope scented. Sepals pale green. Said to be a common species." Vernacular name : *kelampoh.*

Apparently the first record from Borneo of this Javanese species. Probably occurring also in S. Sumatra, if a sterile specimen from Enggano (*Lütjeharms* 3969) is correctly referred here.

The following reductions of species not represented in the Oxford University Expedition's collection appear to be necessary.

Elaeocarpus ferrugineus (Jack) Steud., *Nomencl.*, ed. 2, **1,** 545 (1840).
Monocera ferruginea Jack in *Mal. Misc.* **1,** no. 5, 44 (1820).
Elaeocarpus jackianus Wall. ex King in *Journ. As. Soc. Beng.* **60,** II, 137 (1891) (*Mat. Fl. Mal. Penins.* no. 3, 246) ; Ridl. in *Kew Bull.* **1938,** 234 (1938).
E. borneënsis R. Knuth in Fedde, *Rep. Spec. Nov.* **44,** 127 (1938), **syn. nov.**

Elaeocarpus nitidus Jack in *Mal. Misc.* **1,** no. 5, 41 (1820).
[*E. parvifolius* Wall. sensu King in *Journ. As. Soc. Beng.* **60,** II, 123 (1891) ; Ridl. in *Kew Bull.* **1938,** 234 (1938); vix C. Muell. *Annot. Fam. Elaeocarp.* 24 (1849).]
E. nigropunctatus Merr. in *Journ. As. Soc. Str. Br.* **1917** (3), no. 77, 196 (1917), **syn. nov.**
E. barbulatus R. Knuth in Fedde, *Rep. Spec. Nov.* **44,** 126 (1938), **syn. nov.**

Elaeocarpus procerus A. DC. in Elm. *Leafl. Philipp. Bot.* **2,** 636 (1909)
E. fusicarpus Elm. *Leafl. Philipp. Bot.* **4,** 1174 (1911), **syn. nov.**

Aglaia kunstleri King (Meliaceae), a species delenda.—*Aglaia kunstleri* was founded by King, in *Journ. As. Soc. Bengal*, **62,** 557 (1894) (*Mat. Fl. Mal. Penins.* no. 6, 69), upon two specimens of *King's Collector* (Kunstler), nos. 5287 (fruit) and 10610 (flower), from Perak, F.M.S., neither being designated as the type. I was recently struck by certain differences between these two specimens : in no. 5287 the leaf-rhachis was more or less terete but minutely roughened all over (almost 'shagreened'), whereas in no. 10610 it was rather strongly angled but otherwise smooth (the roughness or smoothness also applied to the inflorescence). There were also less evident differences in the texture and nervation of the leaflets : *e.g.*, in no. 10160 the nerves were more distant and the leaflets more gradually narrowed to the base. It was soon found that the fruiting material, no. 5287, was conspecific with *Aglaia leucophylla* King (*l.c.* 554 ; *Mat.* p. 66), and it was then assumed that no. 10160, the flowering specimen, could be regarded as the type of *A. kunstleri*. Shortly afterwards, however, there came under observation, at the end of the genus in Ridley's arrangement, *Aglaia heteroclita* King (*l.c.* 566 ; *Mat.* p. 78), and it was at once obvious that the flowering material of *A. kunstleri* was none other than this.

The matter does not end there. *Aglaia simplex* Merrill (*Univ. Calif. Publ. Bot.* **15,** 128 : 1929) is clearly conspecific with *A. leucophylla* King. Merrill's species was based on *Elmer* 21489, from near Tawao, North Borneo. The same species is also represented by *Kloss* 19160, from Bettotan, near Sandakan, 19 August 1927, distributed by Merrill as a new species under an unpublished binomial commemorating the collector's name, and by two specimens collected by *J. & M. S. Clemens* on Kinabalu in 1931 : no. 26249, from Tenompok, 1500 m., 1 Sept., and no. 26757, from Dallas, 900 m., 16 Oct.

The two species *A. leucophylla* and *A. heteroclita* are probably not very closely related, in spite of a superficial similarity in the foliage, which dries a pale yellowish green. *A. leucophylla* has a very large, diffuse, spreading inflorescence of minute flowers, and globose fruits (when ripe) 2 cm. in diameter (as described by King under *A. kunstleri*), while in *A. heteroclita* the inflorescence is very much smaller, more compact, contracted and robust, with much larger flowers, and pyriform fruits, up to 2·5 cm. long and 2 cm. in diameter, according to King. Two specimens from Kinabalu, however, *Clemens* 26681 and 27411, appear to combine the robust contracted inflorescence of *heteroclita* with the roughness of *leucophylla*, and may represent a third, more or less intermediate, species. The roughened petiole and inflorescence-axis is in any case a character shared by several other species.

The synonymy of the two species involved in the disintegration of *A. kunstleri* may therefore be set out as follows :

Aglaia leucophylla King in *Journ. As. Soc. Bengal*, **62,** 557 (1894) (Mat. Fl. Mal. Penins. no. 6, 69) ; Ridley, *Fl. Mal. Penins.* **1,** 403 (1922).

A. kunstleri King, *l.c.* 557 (Mat. p. 69) ; Ridley, *l.c.* 406 ; quoad King's Collector 5287 et descr. fruct.

A. simplex Merr. in *Univ. Calif. Publ. Bot.* **15,** 128 (1929).

Aglaia heteroclita King, *l.c.* 566 (Mat. p. 78) ; Ridley, *l.c.* 410.

A. kunstleri King *l.c.* 557 (Mat. p. 69) ; Ridley, *l.c.* 406 ; quoad King's Collector 10160 et descr. fl.

H. K. Airy Shaw.

SOURCES OF POISONOUS HONEY.

F. N. Howes.

Instances of human beings suffering from poisoning or ill effects through eating certain kinds of honey have been recorded from many parts of the world in the past. There is now a good deal of definite evidence to show that certain plants when worked by the hive bee may be responsible for honey that proves harmful, at any rate under certain conditions or at certain seasons.

The earliest account of honey poisoning is probably that given by Xenophon whose soldiers suffered from it during the retreat of the Ten Thousand and while encamped at Trebizond on the shores of the Black Sea in 400 B.C. He gives a description of the effect of the honey on soldiers who had eaten it stating that they lost their senses, vomited, and were affected with purging. Those that had eaten but little were intoxicated, whilst those that had eaten a good deal were like mad men. It is generally supposed that the honey was derived from Rhododendron (*R. ponticum* L. . There have been other accounts of honey poisoning in this and neighbouring regions considered to be due to *Rhododendron* (6). A more recent account of honey poisoning attributed to species of Rhododendron is that given by Kingdon Ward in " A Plant Hunter's Paradise " (p. 110). When at the village of Tahawndam in Upper Burma, near Tibet, honey brought in by the headman in early May) affected two members of the party, causing one to collapse suddenly. The symptoms soon passed. They were described as resembling acute alcoholic poisoning. The honey in question was considered to be derived from local Rhododendrons. It would seem, therefore, that species of *Rhododendron* other than *R. ponticum* may be responsible for honey poisoning.

According to Mosolevsky (Bee World 1929. p. 141 : 1942. p. 31) poisoning from *Rhododendron* honey is much in evidence in some districts in the Caucasus as soon as the consumption of comb honey commences. It takes place to some extent every year but is more pronounced in dry seasons than in wet. The first symptoms generally arise three or four hours after eating. Fatal cases with it occur mostly with children. This may be due to the tendency for children to consume more honey per unit of body weight than do adults. In general the most frequent references to honey reputed to be poisonous relate to areas round the Black and Caspian Seas (8).

The Pontic Rhododendron (*R. ponticum* L.) is freely cultivated and naturalised in other countries including the British Isles, and it is interesting to record that it has been suspected of being the cause of unwholesome honey in Britain on a few occasions. Normally the flowers are not worked to any extent for nectar by hive bees in Britain although much frequented by bumble bees that are probably better able to reach the nectar, with their much longer tongues. Possibly when conditions are particularly favourable for nectar secretion honey bees obtain a certain amount of nectar. According to Herrod Hempsall (2) a sample of honey from Cobham, Kent, examined by him and alleged to be from Rhododendron was found to have emetic properties by all who partook of it. In another instance at Camberley, Surrey, referred to by a well known

beekeeper, when new comb honey was eaten for breakfast symptoms of poisoning were experienced (giddiness, distorted vision, perspiration, etc.). Not all the members of the family who had eaten the honey from the same comb were affected. The supposition was that possibly only some cells of the comb contained the poisonous honey. Numerous Rhododendrons grew in the vicinity. What may be another case of possible Rhododendron honey poisoning in England is that recorded by a Nottinghamshire doctor who had known boys who had robbed bumble bees nests to suffer from vomiting, purging and abdominal pains (3).

In Japan the shrub *Tripetaleia paniculata* Sieb. & Zucc. is the source of unwholesome honey in mountain districts where it may occur in abundance. The honey is said to have a pungent taste and the severity of the poisoning to vary with different individuals (3).

In North America several different species have been suspected of being the cause of honey poisoning such as *Kalmia latifolia* L. (Calico Bush or Mountain Laurel), *Gelsemium sempervirens* Ait. (Yellow Jessamine) and possibly species of *Pieris*, *Andromeda*, and *Leucothoe*. In regions where *Kalmia latifolia* is common in the eastern United States, farmers and beekeepers have been known to first feed honey which they look upon with suspicion to the dog. If no ill effects are noted within a few hours children and other members of the family are allowed to have the honey. As far back as 1875 a Dr. Grammer who had been a surgeon in the Confederate Army stated in an American beekeeping journal, " Wherever the Mountain Laurel grows the bees are very fond of it . . . It is dangerous for any one unable to detect the taste to eat the honey. It has a highly poisonous effect, being an extremely distressing narcotic, varying in its effects in proportion to the quantity eaten. During the war I had many opportunities of witnessing its effects and on one occasion, personal experience gave me the right to say that I know something about it . . . Some time after eating a queerish sensation of tingling all over, indistinct vision, caused by dilation of the pupils, with an empty dizzy feeling about the head and a horrible nausea which would not relieve itself by vomiting.

"The first case or two that I saw were entirely overpowered by it, and their appearance was exactly as if they were dead drunk . . . the enervation of all the voluntary muscles was completely destroyed. The usual remedies for narcotics partially restored them in a few hours, but the effects did not completely wear off for two or three days, and I was assured that fatal consequences have been known to follow a too free indulgence." (7).

There has been much difference of opinion regarding the honey of the American yellow jessamine or Carolina jasmine (*Gelsemium sempervirens*) being poisonous. One writer attributes fatal consequences to honey derived from this source at Branchville, South Carolina, and states, " A boy eleven years old was the first of the family to eat some of the honey. In an hour afterward the child became giddy and staggered as he walked, and could not see. He was affected with general lassitude and slight nausea. In two hours he was seized with convulsions and died. The honey was given to a negro woman who gave it to her children. In one hour two of these children died, after an attack of dizziness, blindness and nausea. Several other persons who ate the honey were made sick in similar manner but vomited, and thus escaped fatal consequences." (7).

The yellow jessamine is a well known climbing vine common to the southern States from Virginia to Florida and west to Mexico. It is known to be poisonous and to be the cause of death in livestock. The fragrant yellow flowers appear in early spring. It has been suspected that the flowers may be the cause of death among bees, but there appears to be uncertainty on this score.

It is of interest to note that all the species so far mentioned, with the exception of *Gelsemium*, are members of the *Ericaceae*. However, other members of the family are known to be good honey sources and honey derived from them has never been held suspect. Examples are ling (*Calluna vulgaris* Salisb.), the source of much honey in several western European countries, and various heaths (*Erica* spp.).

It is often stated that where honey proves poisonous or unwholesome this only applies if the honey in the comb is eaten in the " unripe " or uncapped state and that once the cells are capped over by the bees and the honey properly ripened in the hive it ceases to be harmful. From the general evidence available it would seem that this may well be so with poisonous honey from *Rhododendron*, but it doubtless does not apply in all instances.

Recently an interesting outbreak of honey poisoning has been recorded and investigated in New Zealand by Palmer Jones and others (5). It occurred at Pongakawa, in the Bay of Plenty district, North Island, in 1945. The honey responsible for the poisoning was from a single apiary of some fifteen hives situated approximately 10 miles from Pongakawa and 25 miles from Te Puko. All the toxic honey was from the last extraction of the season, obtained in February, and was approximately 200 lbs. It was thoroughly mixed before being drawn off into containers. Fortunately much of the honey was retrieved and served as a basis for investigation. The persons who ate the honey suffered from vomiting, unconsciousness, and abdominal pains. Temporary loss of memory also occurred in several instances.

At a mill where the camp cook had provided some of this honey eighteen people were affected and twelve were taken to hospital, including the cook. The severity of the attacks appeared proportional to the amount of the honey eaten. In another instance a man ate only a teaspoonful of the honey and was affected within three hours. He went pig hunting after eating the honey and had difficulty in returning home. After reaching his home he became unconscious for some time. His wife, who took only a half to one teaspoonful of the honey to sweeten her tea was affected within eight to twelve hours. In another instance a " Mr. H. ate some honey on April the 19th, and at noon the following day had a fit, followed by others at 5 p.m. and 11 p.m. Symptoms were unconsciousness, and on reviving, temporary loss of memory. Vomiting and pain in the abdomen were experienced. He continued, in spite of these symptoms, to eat the honey, until he had eaten about 1 lb. When interviewed on April 28th he was still feeling weak and unfit for hard work." (5).

Feeding tests with the honey were carried out on various animals. It was found that pigs, sheep, rabbits, mice and bees were not susceptible to it. Rats were only slightly susceptible, but guinea pigs very sus-

ceptible. Guinea pigs were therefore used to study symptoms and to follow the course of chemical extractions.

A substance of formula $C_{15}H_{18}O_7$, for which the name " mellitoxin " was suggested, was isolated from the honey. It was found to be toxic to guinea pigs causing identical symptoms with those caused by the honey itself, and was considered to be one of the picrotoxin class of poisons. There was evidence of the presence of a second toxic substance in the honey.

Field observations in the immediate neighbourhood of the apiary from which the poisonous honey had been obtained showed that the vegetation consisted largely of bracken and tea tree (*Leptospermum scoparium*) and that " tutu " (*Coriaria arborea*) was very prevalent. The latter, being known to be a poisonous plant, was regarded with suspicion. Bees were known to collect pollen from the flowers, but examination of the flowers showed that they were without nectaries and therefore always devoid of nectar. Tests carried out with the pollen showed that it was entirely without toxic properties. However, further observation showed that the leaves of the " tutu " were sometimes covered in honeydew, due to the activities of the vine hopper, *Scolypopa australis*, and that hive bees were known sometimes to collect this honeydew, particularly during hot weather when floral nectar from other plants was absent or scarce. An extract of the honeydew dosed to guinea pigs proved toxic and mellitoxin was isolated from the honeydew. Nevertheless, bees are able to harvest the toxic honeydew without being adversely affected themselves. The honey stored in the hive from bees collecting honeydew from *Coriaria arborea* is described as of a light amber colour and of a sticky consistency, considered to be due largely to the dry climatic conditions. It appeared to have no outstanding peculiarity that would enable beekeepers to identify it when stored in the combs.

Coriaria arborea is a widely distributed and well known tree or shrub in New Zealand, and reaches a height of about 25 feet. It is reputed to be more prevalent in North than in South Island and is common by streamsides and in forest margins. It often has a spreading habit. According to Allan (1) its exact distribution is uncertain for it has been confused with *Coriaria sarmentosa* Forst., a species with which it hybridizes. It bears long pendant inflorescences up to a foot or more in length and small greenish flowers that produce an abundance of a light, wind-borne pollen. Under certain conditions—when the weather is dry and there is heavy infestation of vine leaf hopper, honeydew may be produced very freely and cover all the leaves on the secondary branches. Sometimes the viscosity of the honeydew is so great as to be considered rather unavailable to bees, but at other times it is of a watery consistency and readily drips on to the leaves below or on to the leaves of other plants. In this state it may remain for some time in a condition suitable for bees to feed on.

In considering the early history of honey poisoning in New Zealand it is of interest that most of the cases are stated to be from the Bay of Plenty district, where the severe 1945 outbreak occurred. As the country became developed much of the indigenous shrub, including *Coriaria*, was cut out and gave way to pasture, often composed largely of clover that afforded profitable and safe bee pasturage. Consequently cases of honey

poisoning became less prevalent. In considering past outbreaks of honey poisoning in the light of the recent discoveries it is considered that they may well have been due to honeydew from *Coriaria arborea*. It has been noted that the toxic honey has usually appeared after the second week in February and has been from hives within bee range of large quantities of "tutu". It is only necessary to assume the presence of hoppers to duplicate the condition of the 1945 outbreak.

However, it is considered that "the conditions which produce poisonous honey are so unusual that areas considered potentially dangerous must be very few in New Zealand, and small in extent. They are also steadily decreasing with closer settlement. Such areas would not produce a high grade of honey, and their loss to the industry if closed to beekeeping would be small. Therefore it should be possible to avoid future trouble by preventing the keeping of bees in areas where the hopper is abundant in hot, dry summers, and tutu is common. Measures are being taken to close the affected area immediately to commercial beekeeping until the danger of honey-dew production from tutu in the Pongakawa Valley and adjoining waste lands has passed with closer land settlement and clearance of comparatively large areas of tutu growing in sheltered locations in that district at present." (5).

These interesting investigations carried out in New Zealand by Palmer Jones and his co-workers have shown definitely that insect honeydew on an indigenous plant may be the cause of poisonous honey. This automatically directs attention to the possibility of honeydew from other plants in other lands also being a cause of poisonous honey. There is much uncertainty as to the cause of poisonous honey in some countries and it may well be that honeydew may be a factor. The New Zealand work should induce other investigators to bear this constantly in mind.

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THE BOTANICAL GARDENS AND MUSEUM AT BERLIN-DAHLEM.

We have received the following report on the condition of the Gardens and Museum from Dr. H. Sleumer. The report is dated 1.11.48.

Botanical Museum.

After the destruction of close on 70 per cent. of the buildings in the years 1943-45, the following have been made serviceable :—

In the *North Wing* the lowest storey with laboratory, library, and a few workrooms as well as the basement. In the *West Wing* half of the large room on the second floor, which has for the time being been arranged as a Herbarium ; above it, several garrets under the roof ; parts of the first floor, the galleries of the first floor and the entrance hall, which together have been arranged as a Museum for the public (exhibit of tropical economic plants ; Fungus exhibit) ; the entire basement with the spirit material. The entire *East Wing* (formerly Library and General Herbarium) has been completely destroyed, and the debris has already been used to rebuild the partially destroyed West and North Wings.

Of the Scientific collections existing up to 1943, the following have been saved :—

1. The entire material of the Fungi imperfecti ; *Uredineae* ; *Equisetaceae* ; *Lycopodiaceae* ; *Selaginellaceae* ; *Psilotaceae* ; *Isoetaceae* ; all the families of *Filicinae* ; *Pandanaceae* ; *Balsaminaceae* ; *Begoniaceae* ; the genus *Antirrhinum.*

2. The types and cotypes of the following families (at least one sheet) of every species represented in the General Herbarium of 1943. *Cephalotaxaceae*; *Taxaceae*; *Gnetaceae. Typhaceae*; *Sparganiaceae*; *Aponogetonaceae* ; *Gramineae* excl. *Bambuseae* ; *Cyperaceae-Cyperus* and *Heleocharis* pro parte (all the remainder burnt) ; *Palmae* pr. p. ; *Araceae* ; *Flagellariaceae* ; *Restionaceae* ; *Centrolepidaceae* ; *Mayacaceae* ; *Xyridaceae* ; *Eriocaulonaceae* ; *Rapateaceae* ; *Bromeliaceae* ; *Commelinaceae* pr. p. ; *Stemonaceae* ; *Liliaceae* ; *Amaryllidaceae* ; *Taccaceae* ; *Dioscoreaceae* ; *Iridaceae* ; *Scitamineae* pr. p. min. ; *Burmanniaceae* ; *Corsiaceae.*
   Casuarinaceae ; *Piperaceae* ; *Ulmaceae* ; *Moraceae* ; *Proteacece* ; *Myzodendraceae* ; *Santalaceae* ; *Opiliaceae* ; *Grubbiaceae* ; *Olacaceae* ; *Octocnemaceae* ; *Loranthaceae* ; *Polygonaceae* ; *Amaranthaceae* ; *Portulacaceae* ; *Nymphaeaceae* ; *Ceratophyllaceae* ; *Berberidaceae* ; *Menispermaceae* ; *Magnoliaceae* ; *Lactoridaceae* ; *Anonaceae* ; *Lauraceae* ; *Hernandiaceae* ; *Papaveraceae* ; *Capparidaceae* ; *Cruciferae* ; *Tovariaceae* ; *Resedaceae* ; *Nepenthaceae* ; *Droseraceae* ; *Podostemonaceae* ; *Hydrostachyaceae* ; *Saxifragaceae* pr. p. ; *Cunoniaceae* ; *Myrothamnaceae* ; *Bruniaceae* ; *Hamamelidaceae* ; *Rosaceae* pr. p. min.

3. The Willdenow Herbarium originally contained 20,260 Sheets. During the evacuation 27 folders containing 1,061 sheets of the most varied families were lost but have recently been recovered (June 1949), so that the Herbarium is now complete.

4. About 50 folders containing a Herbarium Occidentale with specimens from Spain and Portugal.

5. Numerous duplicates of older and more recent collectors. Amongst them parts of the herbaria of Peter (East Africa), Schlieben (East Africa), Zenker (Cameroons), Stolz (Tanganyika), Clemens (New Guinea), Troll (Bolivia), parts of the Herbarium dendrologicum of K. Koch, the Hieracium Herbarium of Touton and Schack, the Rose Herbarium of Dingler, the Cyperaceae Herbarium of Kükenthal (with the exception of Carex and Cyperus).

6. Comprehensive material, not yet incorporated, from earlier exchange associations, mostly of tropical origin. Large parts of the Bornmüller Herbarium (Orient, partially burnt with the General Herbarium).

7. A considerable portion of the Palm Herbarium and the collection of palm fruits belonging to it, have been saved.

8. The collection of coniferous cones including types.

9. The collection of large timber samples is almost intact.

10. Almost the whole of the spirit material (fruits and flowers corresponding to the Herbarium numbers), including numerous types, especially from Africa.

Of these collections about 1,000 folders of the Filicinae (see para. 1) have not yet been brought back to the Botanical Museum.

Fresh acquisitions, which have remained intact in the Botanical Museum.

11. Large predominantly European herbaria of Engelhardt, Bothe, R. Schulz (Mark Brandenburg), R. Gross (containing several thousand Cyperaceae from all parts of the world as well as the collection of C. Jürgens from S.E. Brazil), Fiedler, Mauzka, Reuss, as well as other smaller herbaria.

12. The Dinter Herbarium (S.W. Africa), with more than 100 folders.

13. The comprehensive Cryptogam collection of the former Agricultural College in Berlin (Mosses and Lichens ; Fungi) together with the Cryptogams of Rabenhorst.

14. Duplicates from the V. Schiffner Herbarium (Liverworts).

15. The Ascomycete Herbarium of Kirschstein.

The entire phanerogam and cryptogam material, at present in the Botanical Museum, Berlin-Dahlem, including the *Filicinae* (mentioned in para. 1, whose return should take place shortly), should number more than half a million sheets. Of these about two-thirds of the phanerogam specimens at present available can be made accessible in the newly repaired large Herbarium-hall in the West Wing (2nd Floor) together

with the Willdenow Herbarium and the types. The cryptogam collections will be housed in the lower rooms of the Director's villa outside the Museum building.

Library. The Library of the Botanical Museum was completely destroyed in 1943. Since then about 20,000 volumes of books and periodicals have been acquired, amongst them the libraries of Bornmüller and Kirschstein. Of reprints there are about 60,000 items, amongst them the valuable Haberlandt collection.

For want of space and shelves it has so far been possible to arrange only a small part of the Library. Most of the books are still packed up in cases.

Of periodicals on systematic botany the following have appeared since 1945 : *Bot. Jahrbücher* Bd. 74, Heft 1, and *Bibliotheka Botanica* Heft 120, both published by Schweizerbart of Stuttgart. Scientific Editor : Prof. Dr. R. Pilger.

The former *Notizblatt des Bot. Gartens u. Museums, Berlin-Dahlem*, will, it is anticipated, appear in 1949, but under a new and shorter title, and available for exchange with other botanical institutions. Those copies of the parts of the Notizblatt (Bd. 15, Heft 1–7, pp. 1–394) which appeared during the war and were ruined by the catastrophic fire of 1943, are to be reprinted for exchange purposes.

The continuation of the *Pflanzenreich* is under consideration by the German Academy of Sciences.

Negotiations are going on with regard to the continuation of the *Natürlichen Pflanzenfamilien*. It is hoped that the *Rhamnales* already in print will shortly appear, as well as the account (already to hand as finished manuscript) of the *Rhodophyceae* by H. Kylin. Scientific Editor : Prof. Dr. J. Mattfeld.

Botanical Garden.

During the war some 65 bombs and many hundreds of incendiary bombs fells in the grounds (42 ha.) of the Botanic Gardens. Further extensive damage was caused during the fighting around Berlin. About one quarter of the trees was lost. The outdoor beds have been again put into comparative order. Of the greenhouses with their glass area of some 13,000 sq. m. only about half of the nurseries have so far been reglazed, with about 1,500 sq. m., and provisionally heated. The greater part of the tropical and sub-tropical hot-house plants were killed during the war and in the first post-war winter (for want of fuel). About two-thirds of the succulents, certain Cycads and Ferns, small palms and a few economic plants were saved. The engine house together with the heating system was re-installed in 1948. A small show-house, with Palms, Araceae, Cycads, Insectivorous plants, Orchids and Succulents, was opened to the public in 1948.

Scientific Personnel

Director : Prof. Dr. R. Pilger (Coniferae ; Gramineae ; Plantago) also Professor of Botany in the University of Berlin.

Keepers and Professors:—

Dr. J. Mildbraed (African Flora)
Dr. E. Ulbrich (Fungi, Fibre Plants)
Dr. M. Burret (Palms)
Dr. J. Mattfeld (Compositae ; Library)
Dr. E. Werdermann (Succulents)
Dr. H. Melchior (Museum)
Dr. H. Reimers (Ferns ; Mosses)

Assistants :—

Dr. H. Sleumer (Flacourtiaceae ; Ericales)
Dr. G. M. Schulze (Impatiens)
Dr. F. Mattick (Lichens).

Cymbopogon pospischilii (*K. Schum.*) *C. E. Hubbard*, comb. nov. *Andropogon pospischilii* K. Schum. in Engl. Bot. Jahrb. **24** : 328 (1897) ; Stapf in Prain, Fl. Trop. Afr. **9** : 265 (1919) ; Peter in Fedde, Repert., Beih. **40** : pt. 1, 138 (1929).

When the account of the genus *Cymbopogon* was prepared for the Flora of Tropical Africa, the type-specimen of this species was not available for study at Kew and because of Schumann's very incomplete description, Stapf was forced to include this grass with the imperfectly known species of *Andropogon*. Since then the Director of the Berlin Herbarium has very kindly presented a fragment from the type. This agrees with Schumann's description except for the awns being 9–10 mm. in length, not 18–20 mm., a discrepancy which was probably due to confusion between millimetres and lines. The species is very similar to *Cymbopogon floccosus* (Schweinf.) Stapf and to *C. divaricatus* Stapf, which have a more northerly distribution, from Eritrea to British Somaliland. From the former, *C. pospischilii* may be distinguished by its taller culms (up to 1 m. high), longer leaf-blades (up to 30 cm. long), and especially by its racemes which diverge widely and finally become epinastically deflexed. *C. divaricatus* resembles *C. pospischilii* in possessing spreading or deflexed racemes, but the latter has the leaf-blades perfectly smooth beneath—not minutely and closely scabrid. Furthermore, in both *C. divaricatus* and *C. floccosus*, the pedicel of the lowest pedicelled spikelet of the subsessile raceme is distinctly swollen and often glabrescent, whereas in *C. pospischilii* it is not conspicuously different from the other pedicels.

Cymbopogon pospischilii is known at present from the following localities.

Kenya Colony : Nairobi, National Park, numerous and sometimes dominant on rocky red soil near Athi River, August 6, 1948, *Bogdan* 1867 ! Nakuru to Eldame Ravine road, Esageri Station, in light *Acacia* forest, subdominant in grass-cover, 1800 m., Sept. 11, 1948, *Bogdan* 2019 ! South Kavirondo ; Karachonya, 1110 m., May 1, 1925, *Spranger* S.29 ! Near Muani. *Pospischil* !

C. E. Hubbard.

POGONACHNE BOR : A NEW GENUS OF INDIAN GRASSES.

N. L. Bor.

Pogonachne *Bor*, gen. nov. cum *Sehima* Forsk. comparandum sed ab eo inflorescentia racemosa, spiculis sessilibus nullis, spiculis pedicellatis hermaphroditis recedit.

Inflorescentia racemiformis e vaginis foliorum superiorum orta. Spiculae omnes pedicellatae e pedicellis facile disarticulantes, similes; pedicelli in articulationibus rhacheos planae articulatae tarde disarticulantis insidentes, complanati, uno margine dense ciliati, apice bidentati, facile disarticulantes. Spiculae callus crassus, conicus, margine inferiore barbatus. *Anthoecia* duo; inferum vacuum, superum hermaphroditum. *Gluma inferior* lanceolata, dorso rotundata, apice plana, coriacea ; *gluma superior* crasse coriacea, marginibus tenuior, dorso rotundata, dorso supra medium crista pilorum crassa albidorum instructa, supra cristam anguste alata. *Anthoecium inferum* vacuum; *lemma* lanceolatum, 3-nerve, hyalinum; *palea* ad squamam hyalinam redacta. *Anthoecium superius* hermaphroditum; *lemma* bilobatum, e sinu valde aristatum; *palea* brevior, hyalina; aristae columna brunnea, torta. *Antherae* tres; lodiculae duae, cuneatae; styli duo, longi; stigmata plumosa.

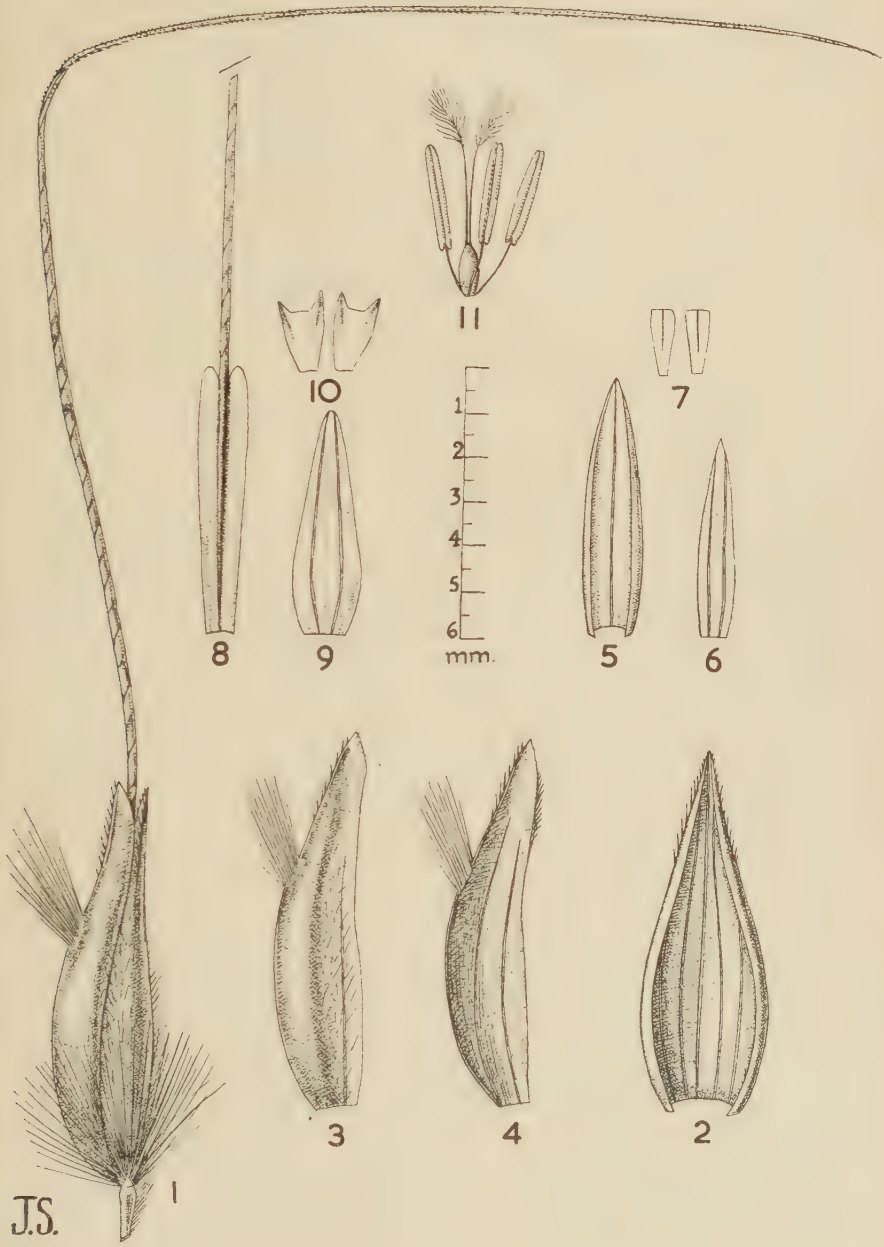
Gramina annua robusta, nodis inferioribus radicantia.

Species adhuc unica.

Pogonachne racemosa *Bor*, sp. nov.

Gramen annuum. *Culmi* ad 1 m. alti, robusti, ad 1 cm. in diametro, laeves teretesque, ramosi, nodis inferioribus radicantes ; nodi inferne approximati. *Foliorum laminae* ad 25 cm. longae, 1·5 cm. latae, lineares, acuminatae, marginibus scaberrimae, utrinque pilis albidis vel pullis e tuberculis ortis tectae ; *foliorum vaginae* laxissimae, laeves glabraeque, internodiis breviores, e culmis deciduae ; vagina superior sine lamina, inflorescentiae pedunculum longum complectens ; *ligula* 3 mm. longa, membranacea, laciniata.

Inflorescentia simpliciter racemosa, 4–6 cm. longa ; racemi singulo nodo nonnulli orti. *Spiculae* 1 cm. longae, articulationibus rhacheos planae pedicellatae ; rhacheos internodia 4 mm. longa, utrinque plana vel pedicellos versus leviter excavata, uno margine dense ciliata, ceterum glabra ; pedicellus 2·5 3 mm. longus, cuneatus, complanatus, apice obliquus, bidentatus ; rhacheos nodi sparse barbati. Spicula sessilis nulla, inter pedicellum et internodium ad sqamam parvam redacta. Spicula pedicellata 1 cm. longa, callo crasso conico 1 mm. longo insidens ; calli margo inferior dense barbatus. *Gluma inferior* 9 mm. longa, dorso rotundata, explanata lanceolato-acuta, multinervis, coriacea, apicem versus transverse complanata, bicarinata, dorso et lateribus molliter pilosa ; carinae apicem versus spinosae ; *gluma superior* 9 mm. longa, dorso crasse coriacea, lateribus tenuior, 5-nervis, dorso supra medium crista pilorum albidorum instructa, dorso apicem versus carinata et compressa, dorso sparse pilosa ; carina spinulosa. *Anthoecium inferum* vacuum ; *lemma* lanceolatum, hyalinum, 3-nerve ; *palea* 4 mm. longa,



1. Spikelet of Pogonachne.
2. Lower glume.
3. Upper glume from the side—outer surface.
4. Upper glume from the side—inner surface.
5. Lower Lemma of lower floret.
6. Palea of ditto.
7. Lodicules of ditto.
8. Lemma of upper floret.
9. Palea of ditto.
10. Lodicules of ditto.
11. Stamens and ovary of ditto.

hyalina ; *lodiculae* anguste cuneatae, 1 mm. longae. *Anthoecium superum* hermaphroditum ; *lemma* oblongum, bilobatum, 5–6 mm. longum, inferne 2-nerve, aristatum ; arista robusta e sinu intra lobos exiens, 3·75 cm. longa ; columna scabra, torta, 2 cm. longa ; *palea* 3·5 mm. longa, oblonga-obtusa, hyalina, 2-nervis. *Antherae* tres, 2·5–3 mm. longae. *Lodiculae* duae, 2 mm. longae, cuneatae, aliquando bidentatae. *Styli* duo, 3 mm. longi, e basi liberi ; stigmata plumosa.

India orientalis. Bombay, Khandala, Poona District, Oct. 1918, *Blatter et McCann*, 9925, 9926. Matheran, Western Ghats, 25 Oct. 1896, *Woodrow* (Typus in Herb. Kew.). Name from πώγων beard, and αχνη scale.

This species has apparently been confused in the past with *Ischaemum spathiflorum* Hook. f., Flor. Brit. Ind. **7,** 138 (1896), a species which has been transferred to *Sehima* by Blatter and McCann, Bombay Grasses, 20 (1935).

It cannot be denied that there is a certain superficial resemblance between the two grasses, particularly in their vegetative parts and in their inflorescences supported by spathes. When the inflorescence is examined however, the unique structure of *Pogonachne* is revealed. The inflorescence is a simple racme which combined with a fragile rhachis is unique in the *Andropogoneae*. Closer examination will show that in the axil between the base of the pedicel and the internode of the rhachis, there is to be found a rudimentary spikelet which consists at the most of a short hyaline scale. The pedicelled spikelets which are 2-flowered, with the upper floret hermaphrodite, are deciduous from the pedicels at maturity. The pedicel remains attached to the articulate rhachis for some time and then the pedicels fall and the rhachis breaks up.

It is difficult to decide into which sub-tribe of *Andropogoneae* the species falls since there is no sub-tribe which has the character of the single fragile raceme and pedicelled hermaphrodite spikelets. It must be assumed for the purposes of classification that this genus is derived from a genus which had at one time both sessile and pedicelled spikelets. That this is likely is indicated by the remants of a sessile spikelet at the articulations of the fragile rhachis. A further assumption must be made to fit the genus into the usually accepted scheme of classification—that the pedicelled spikelet took on the characters of the sessile spikelet when the latter disappeared, in that it became hermaphrodite instead of remaining male or reduced in some other way. If these assumptions are accepted the genus can be sunk in the sub-tribe *Ischaeminae* without any difficulty. It comes closest to *Sehima* Forsk. of all the genera included in *Ischaemininae*, and, as has been said above, resembles *Sehima spathiflorum* (Hook. f.) Blatt. et McCann, very closely in appearance.

THE BASIC PRINCIPLES OF THE DISTRIBUTION OF THE VEGETATION OF AFGHANISTAN[1]

I. A. Linchevsky and †A. V. Prozorovsky[2]

(Translated by H. K. Airy Shaw)

I. Introduction

Afghanistan, a country separating the deserts of Central Asia from the tropical forests of India, bordered on the west by the *solonchak* plains and desert foothills of Iran, while abutting to the east on the snowy peaks of the Himalayas, in virtue of its geographical situation long ago attracted the especial interest of botanists studying the flora and vegetation of Nearer Asia.

A further reason for this interest was the fact of Afghanistan being so extraordinarily little known, and the extreme poverty of the botanical literature on this country, as the result of which there has prevailed in botanical, and to some extent in geographical, circles, even up to the most recent times, the notion of Afghanistan as a *terra incognita*—an "unknown land".

These circumstances must also explain the view held by many botanists that the flora and vegetation of Afghanistan conceals within itself the solution to many obscure problems concerning the botanical geography of Nearer Asia; which is undoubtedly the case, but probably to a lesser degree than is generally supposed.

It is beyond dispute that the enrichment of the world's plant collections by gatherings from Afghanistan (hitherto very few) will make possible the establishment in science of not a few new species of plants, will facilitate the disposal in systematic order of Western Asiatic groups of plants whose areas partly include Afghan territory, and will render possible the fuller and more exact evaluation of the botanico-geographical elements of the flora of Afghanistan, and with them those of adjoining territories also, while the study of the vegetation of Afghanistan will fill gaps in our conceptions regarding the plant covering of this part of Asia.

(184)[3] It is, however, uncertain whether we can expect, as a result of the study of the flora and vegetation of Afghanistan alone, a final solution of any major botanico-geographical problems.

This conclusion, of course, in no way diminishes the great scientific interest of the investigation of the flora and vegetation of Afghanistan, the

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[1]In the summer of 1941 the authors of the present paper completed the first draft of their MS "Outline of the Vegetation of Afghanistan", consisting of about 15 printed pages, carried out while preparing monographs on the vegetation of the lands adjoining the U.S.S.R., undertaken by the Geobotanical Section of the V. L. Komarov Institute of the U.S.S.R. Academy of Sciences, under the direction of Prof. E. M. Lavrenko.

The present paper, containing in condensed form the main conclusions of the above-mentioned MS, was written by I. A. Linchevsky in 1943.

In view of the fact that the work on the composition of the original MS was carried out jointly, we naturally retain in this article the joint authorship of A. V. Prozorovsky, who perished prematurely in the spring of 1943.—I.L.

[2][In *Volume Sci. Works Leningr. 1941–1943*, ed. Shishkin, Sokolov, etc., 183–218 : 1946].

[3][Italic numerals in round brackets indicate page numbers of the original.]

significance of which is bound up with the elucidation of its territory as one of the peculiar and least known portions of the extensive and interesting floristic province of the Ancient Mediterranean of the Old World.

It was precisely with such a view (actually the only possible one)—that the territory of Afghanistan (equally with that of any other continental country), its flora and vegetation, do not represent something isolated and self-contained—that the authors thought it possible to undertake the description of the vegetation of Afghanistan, notwithstanding the extreme poverty of the data in the literature, already mentioned.

In actual fact, as may be seen from the list of botanical literature given at the end of this article, out of 35 titles only 18 [1–3, 6, 8, 11, 13, 19–22, 24, 27–29, 30, 32, 35]† refer immediately to the territory of Afghanistan ; of these works, only 10 [1–3, 19, 21, 27–28, 30, 32, 35] contain material on vegetation, while the remaining works are predominantly floristic in character and have been utilised only in small part, in so far as data on the habitats of this or that plant permit an indirect estimate of the character of the vegetation of this or that region.

It was with this object also that such floristic manuals were utilised as the excellent *Flora Orientalis* of Boissier [23], the *Flora of British India* of Hooker [31], the *Flora SSSR* [14], and the treatise of Elwes and Henry [26], which contain a number of items of information on the habitats of Afghan plants.

Some miscellaneous and unfortunately not always very solid material on vegetation was extracted from compositions of a geographical character (descriptions of travels, military-geographical essays and the like) and certain other works, which were gone through with this object by the authors to the number of 250 titles (about 100 being foreign, principally English).

The basic works yielding material for an acquaintanceship with the vegetation of Afghanistan are those of the English writers Griffith [27, 28] and Aitchison [19–22], and also of the Russian investigators Bunge [1] and Vavilov and Bukinich [2, 3]. Of these, the most valuable for botanists are the works of Griffith, despite their being almost a century old, owing to their valuable descriptions of the vegetation along the route which he followed ; the importance of these works is unfortunately diminished by the lack of exact determinations of the plants (their names are given provisionally, from the field-notes of the author, who was unable to work out his extensive collections and journals ; they were published posthumously, without proper scientific elaboration). Very much valuable material is given by Aitchison in his works. Extremely interesting and exact data are given by Bunge. Much material is contained in Vavilov and Bukinich's work, the inadequacy of the descriptions being in many cases compensated by the excellent photographs.

All this material, however, on the vegetation of Afghanistan proper, gathered from all possible sources, could yield only miscellaneous disconnected ideas on the vegetation of the different parts of this country, and many regions have remained quite unelucidated.

† [Ordinary arabic numerals in square brackets indicate literature references at end of article.]

(*185*) It was precisely this character of the material which in fact determined the method of work adopted by the authors in the ensuing pages—that of the widest possible drawing upon of data on the vegetation of countries bordering Afghanistan (the USSR, Iran, India) and the extensive extrapolation of these data into the territory of Afghanistan, subject to the constant checking of the conclusions reached by means of existing factual material. For this purpose the works mentioned in the list of references [4, 5, 7, 9, 10, 12, 15–18, 25, 33] were also utilised, besides a whole number of others not mentioned, including manuscripts.

For the same purpose the authors draw upon materials of the observations of 32 meteorological stations situated in Afghanistan and adjoining countries and, comparing the data of these stations by groups, worked out a system of vertical and regional gradients for the basic climatological elements.

All this made it possible to characterize, both in geobotanical and in climatological respects, the provinces and regions ("circuits") of Afghanistan, distinguished by us primarily according to relief (according to the English map, executed in contours, "India and adjacent countries", scale 1 : 1,000,000, published in separate sheets at Calcutta in 1922–1930), thus securing a more all-round check on all our hypotheses.

The authors have clearly realised that with this method a number of errors cannot be avoided, seeing that the relief of Afghanistan is as yet far from satisfactorily investigated, and that, however exactly the climatic gradients are calculated, they are subject to modifications from local conditions.

The scheme of regionisation, however, that has been elaborated (representing of course a preliminary sketch of the "prognosis" type) seems to us to be quite a plausible one and to reflect in general features the character of the distribution of the vegetation of Afghanistan.

Shortly before the completion of our work, a colleague of the Botanical Institute, L. E. Rodin, returned from a mission in Afghanistan, and readily undertook to look through our MS after its completion.

We were naturally extremely pleased that, in the opinion of L. E. Rodin, who in the course of his 4½ months' stay in Afghanistan had carried out a whole series of interesting itineraries, the main outlines and character of the distribution of vegetation in Afghanistan had been elucidated by us with sufficient accuracy.

We therefore consider it of interest to publish the results which we have obtained in the form of a preliminary scheme, which must of course in the future be subject to considerable precision[1].

II. Main physico-geographical outlines of Afghanistan (mountain relief, climate, soils)

Afghanistan is situated between lat. 30° 25′ and 38° 31′ S. and long. 60° 45′ and 72° 00′ E. (the narrow strip of Wakhan extends eastwards somewhat further, to long. 74° 51′ E.), and borders on the USSR, Iran, India, and, for a short distance in the Wakhan district, China.

[1]Part of these materials were recently published by us in a very condensed form ; *vide* I. A. Linchevsky and A. V. Prozorovsky, Contribution to the knowledge of the vegetation of Afghanistan, *Bot. Journ. SSSR*, **29** (4). 1944.

(*186*) The total area of Afghanistan is reckoned at about 635,000 sq. km., and represents mainly high-mountainous country.

The highest part of Afghanistan is its north-east corner (the Wakhan region), in which lies the eastern part of the Hindukush range, here exceeding 5,000 m. in altitude (average height of passes about 4,000 m.). From this high-mountain knot, mountain chains radiate fanwise, gradually decreasing in height to the periphery (in the north, west, south and south-east), on the north of which there abut the plains of Afghan Turkestan, on the south-west the low-lying plains of Seistan, on the south the desert plains of Desht-i-margo and Registan, and on the east the Dzhelalabad lowland.

The principal watershed is formed by the ranges of the Hindukush and Kuh-i-baba, which extend almost uninterruptedly through northern Afghanistan, continuing westwards as the chains of Bend-i-duakhan, Bend-i-baian and the western Sefid-Kuh.

Westwards from this watershed run streams either falling into the Amu-darya (the Kokcha, Kunduz-darya, etc.), vanishing in the plains of Afghan Turkestan (Khulum, Balkh, Sarypul-ab, Ab-i-kaisar) or ending in the sands of the Karakum within the bounds of the USSR (Murgab, Herirud). To the south-eastwards issue the rivers of the Indus basin (Kabul, etc.), while to the south and south-west flow streams ending in the desert depression of lake Khamun (Hilmend, Khash-rud, Khuspas-rud, Farakh-rud, etc.).

The Hindukush is the largest range in Afghanistan. The range of Kuh-i-baba, commencing somewhat to the south of the Hindukush and connected with it by the Shibar pass, must be regarded as orographically a continuation of it. This is the largest mountain range after the Hindukush, with peaks from 5090 to 3989 metres above sea-level ; to the west of the passes of Akserat and Sharak-kushma it runs into the ranges of Bend-i-duakhan, Bend-i-baian and western Sefid-Kuh, which lie south of the Herirud river, with peaks gradually decreasing in height towards the west from 3752 to 3350 m. above sea-level.

North of the Herirud river stretches the Parapamiz (or Bend-i-baba) range, reaching an altitude of 4535 m. in the east, but descending to 2095 m. in the west. On the north the spurs of the Parapamiz border on the plains of Afghan Turkestan.

To the south of the eastern part of the Hindukush range lies a whole series of ranges, composing the greater part of the basin of the Kabul river, and orographically extraordinarily complicated in the region of Nuristan (Kafiristan). The northern part of these ranges (including also the Sefid-kuh range) has a general latitudinal trend with heights of from 4760 m. (mount Sikaram in the Sefid-kuh) to 4456 m. above sea level ; farther south many of the chains run in a north-south direction.

South of the Kuh-i-baba range and its western spurs, and west of the Kabul ranges, lie the mountains of central Afghanistan, forming a system of ranges extending from north-east to south-west. Its greatest heights lie to the east (in the region of the sources of the Hilmend river), where they reach an altitude of 4,000 m. From the meagre data available, there appear to be no such heights in the southern and western parts of

this mountain region. To the south and west these mountains are bounded by desert plains.

To the south-east of Afghanistan, along the frontiers of India, are situated some geologically young, comparatively low, rocky (*187*) ranges, the spurs of which within the bounds of Beluchistan interlock to the south with the desert depression of southern Afghanistan.

Level regions are situated on the peripheral parts of the country. The most low-lying are the plains of Afghan Turkestan which abut on the Amu-darya, situated at altitudes of about 300–400 m. above sea-level and forming the immediate continuation of the desert plains of Central Asia (Transcaspian depression). The western and southern desert plains of Afghanistan, occupying a territory of about 150,000 square kilometres, bordering on eastern Iran and northern Beluchistan, are situated at heights of 500–800 m. above sea-level. Lastly, a small level region is represented by the Dzhelalabad depression, situated in the eastern part of Afghanistan, and formed by the extensive inter-montane valley of the Kabul river, which here lies at an altitude of about 600 m. above sea-level.

The climate of Afghanistan is practically unknown (regular meteorological observations are carried out only in the town of Kabul) ; hence, as mentioned above, for its characterization use has been made chiefly of the observational data of meteorological stations situated in the regions of neighbouring countries bordering on Afghanistan.

Although the data of these stations are insufficient for the complete characterization of the climate of a number of the regions of Afghanistan (particularly its central portion), it is nevertheless possible on the basis of them to introduce certain correctives into the existing general accounts of the climate.

In general features the climate of Afghanistan is distinguished by marked dryness of the atmosphere, low degree of cloudiness, small quantity of precipitation, hot summers and cold winters, with sharp fluctuations of temperature even in the course of 24 hours.

These features of the climate of Afghanistan, characteristic of the continental regions of the temperate zones of the globe in general, are determined by its situation in the high-pressure belt of the northern hemisphere, remote from sea-coasts, from which, moreover, it is cut off by high mountain chains.

Within the confines of Afghanistan, however, are observed considerable differences in temperature conditions and in the quantity and character of distribution of precipitations, which it is quite impossible to explain merely by the differing heights of the parts above sea-level, as is done for example by Vavilov and Bukinich [3].

Very characteristic of the various parts of Afghanistan (apart from height above sea-level) is the uneven distribution of precipitations, and, connected with this, the differing temperature-conditions, which are determined primarily by the orographical situation of the different regions, in virtue of the extremely sharp barrier effect of the high mountain ranges.

In the territory of Afghanistan it is possible to distinguish 4 climatic provinces, corresponding to the geobotanical provinces described in chapter IV, namely : 1) the South Turkestan transitional province, 2) the Central Asiatic desert province, 3) the Afghano-Iranian desert province, 4) the Indo-Himalayan forest province (see scheme of geobotanical regionisation for Afghanistan, p. *216*).

The greater, south-western, part of Afghanistan, referred by us to the Afghano-Iranian desert province, is situated in the zone of continental subtropical climate of Mediterranean type, with its characteristic pronounced summer drought and prevalence of winter and especially (*188*) spring precipitations. The hottest and driest months here are July and August or June and July, when in a number of regions not a drop of rain falls, the sky is continually cloudless, and the air temperature even at altitudes of more than 2000 m. reaches 28°, and in the lowland plains 48°. The general drought lasts for 6 months. The coldest month is January, the mean temperature of which in the low-lying regions is always above 0°, though frosts are sometimes recorded, reaching —6° in the extreme south (in low-lying valleys).

Frosts continue (in the mountains) for 3–6 months. A continuous snow covering is absent in the low-lying regions, but in the mountains deep drifts are not infrequently observed on the passes. The line of perpetual snow is situated at a high level, varying between 4500 and 6000 m. altitude. The greatest quantity of precipitations at all altitudes occurs in the month of March.

The territory of northern Afghanistan, referred by us (together with southern Central Asia) to the South Turkestan ephemeral province, is analogous in the general features of its climate to the Afghano-Iranian desert province, only differing in absolute climatic index. Thus, the general dryness has here the least duration (up to 3 months), winter frosts are commonly very severe (reaching —33°), and the duration of the period with early frosts amounts to 5–6 months. The distribution of precipitations in the course of the year is on the whole the same as for the Afghano-Iranian desert province.

In the eastern submontane and montane part of the South Turkestan ephemeral province the annual quantity of precipitations is considerably greater than in the west, as can be easily traced on the territory of southern Tadzhikistan, and according to all the data this is also the case in western Badakhshan, in Afghan territory.

A fairly clear natural boundary between the Afghano-Iranian desertic and the South Turkestan ephemeral province is formed by the Parapamiz range and its continuations to the east of the Hindukush *massif*.

The extreme north-east of Afghanistan, where eastern Badakhshan and Wakhan come in, bounded on the south by the gigantic heights of the central Hindukush, belongs to the Central Asiatic desert province and according to all the data has the same climate as the Pamirs, characterized by extraordinary dryness, quite apart from the considerable altitude above sea-level. This region of Afghanistan is climatically (and in its general nature) the immediate continuation of the Central Asiatic highlands, and

its climate may be characterized by the following general features :— Mean annual temperature, 1° ; warmest month, July, coldest, January ; frost-free period lasting about 100 days.

This is undoubtedly climatically the most rigorous district of Afghanistan.

Lastly, a small tract in the eastern part of Afghanistan, referred by us to the Indo-Himalayan forest province, stands climatically isolated. This region comprises the middle course of the Kabul river (the Dzhelalabad valley), and the Afghan Province of Nuristan (Kafiristan), lying to the north of the Kabul river. On the north this district is shut in by the massive elevations of the Hindukush, while to the south-east it immediately descends to the valley of the river Indus, owing to which the influence of the south-western (*189*) Indian monsoon reaches this point, and the climate is referable to the subtropical type, characterized by an appreciable quantity of precipitations in the hot season of the year and extraordinarily mild temperature conditions. Even at heights exceeding 1000 m. there are here no annual frosts, thus permitting the cultivation of lemons, oranges, sugar-cane, etc.

In the higher zones of the mountains of this part of the Indo-Himalayan forest province the climate gradually becomes more temperate, but up to certain heights it is distinguished by considerably greater mildness than in all the other regions of Afghanistan.

The soils of Afghanistan are for the greater part referable to *serozyoms* (grey soils), distinguished by low humus- (1–3%) and high carbonate-content.

Serozyoms are widespread throughout the whole of northern, western, central and southern Afghanistan, differing in different regions in degree of development and salinity. In consequence of the mountainous character of the greater part of Afghanistan and the prevalence of superficial deposits of coarse boulders or gravel, in the major part of montane and southern lowland Afghanistan the soil covering is feebly developed.

Only in the loess foothills of northern Afghanistan (as in the loess foothills of Central Asia) is there a development of clayey *serozyoms*.

In broad basins, and along the margins of oases and river valleys, *solonchak* soils are common, being especially widely distributed in the south-west of Afghanistan in the basin of Lake Khamun.

In the most low-lying regions (by the Amu-darya, and in the south in Registan) considerable areas are occupied by sands.

In the upper parts of the mountain ranges (c. 3000 m. or more above sea-level) the humus content of the soils increases, and they here recall the chestnut soils of the dry steppes. Here, however, as also lower down, there is a predominance on mountain slopes of coarse stony screes, destitute of soil covering.

In eastern Afghanistan—within the bounds of the Indo-Himalayan forest province—owing to the great amount of precipitations and the rich vegetation, there are developed more humus-rich, dark-coloured

soils, probably approaching subtropical *burozyoms* [brown soils], in the lower zones of the mountains, and meadow soils in the highlands.[1]

III. Types of vegetation of Afghanistan

Afghanistan is often termed " the land of stones and rocks", thus underlining the prevalence of dead nature in the landscape. One of the ancient conquerors of Afghanistan, the great Mogul Baber, gives it the following characterization : " The mountains of Afghanistan have a monotonous appearance, the heights (*190*) are middling, the soils denuded, waters scarce, vegetation absent, and the physiognomy mournful and austere".

All investigators of Afghanistan note that the vegetational landscapes of the greater part of this country are wretched and cheerless, reviving somewhat only in spring, when the grass becomes green, and bright tulips, irises, buttercups and other spring flowers come into bloom.

But this bright greenness and vividness of the landscape vanishes in a twinkling as soon as the short moist spring gives place to the burning summer. Sometimes it only needs 2–3 days for the emerald green hills to turn yellow-brown and the landscape to become bleak and cheerless.

Such abrupt seasonal changes in the landscape are not characteristic of the whole of the physico-geographically fairly diverse territory of Afghanistan, but only of its most low-lying desert parts ; at the same time the general character of this seasonality can be traced almost everywhere, in all altitudinal zones, in all types of vegetation, apart from a few areas with a different type of climate.

The sharp climatic seasonality gives rise to the extensive development in Afghanistan of peculiar desert types of vegetation, consisting principally of groups of half-shrubs and small shrubs scattered over the whole profile of the mountains—from their bases to the high-mountain regions.

There is considerably less development in Afghanistan of herbaceous vegetation, which also generally has a desertic, and to a less extent a steppe- and meadow-, character.

Still less developed, territorially, in Afghanistan is true tree and shrub vegetation.

The incompleteness of the materials on the vegetation of Afghanistan, mentioned above, makes it impossible to give a completely authoritative and accurate description of the plant communities or associations composing the plant covering of Afghanistan. A comparative analysis,

[1]As this article was passing through the press, A. N. Rozanov's account, " The Soils of Afghanistan " (*Pochvovedeniye* [Soil Science], Nos. 3–4, 1945, 199–208, 1 map), appeared, being, as the author indicates, " an attempt to summarise the extremely scanty and scattered data on the soils of Afghanistan".

This account contains interesting considerations of the types of soil-formation in Afghanistan (according to the author principally " *serozyom* " and " *burozyom* " types), and rather happily supplements the article of Linchevsky and Prozorovsky, "Contribution to the knowledge of the vegetation of Afghanistan " (*Journ. Bot. URSS*, **29,** no. 4), for A. N. Rozanov, to our satisfaction, completely adopts (except for some changes in the names of provinces and altitudinal zones) the scheme proposed by us for the subdivision of Afghanistan into climatic and geobotanical provinces and altitudinal zones, and arranges his material on soils correspondingly. Rozanov's account can thus equally well be utilised to supplement the present article. *I.L.*

however, of the data on Afghanistan and on the neighbouring parts of Central Asia, Iran and India, makes it possible to indicate a number of plant communities which may be widespread in Afghanistan, judging by the character of the habitats and indications of the occurrence of individual species of plants. In a number of cases, particularly for instance when the landscape rôle of certain plants endemic in Afghanistan is unknown, it is necessary, together with the typological groups, to characterize the geographical complexes, which of course actually consist of a number of ecologically conditioned plant communities.

The results of this analysis are given below, in the form of a list of the possible plant communities, or complexes of them, in Afghanistan, under three main types : 1) desert vegetation, 2) herbaceous vegetation, 3) tree and shrub vegetation.

DESERT VEGETATION

Characterized by the predominance of drought-resistant semi-shrublets, shrublets, semi-shrubs and shrubs (sometimes arborescent plants also). In the case of the semi-shrublets and semi-shrubs, a part of the annual shoots dies down at the end of the growing period. In all these plants there is a clearly expressed adaptation to life in conditions of drought (leaves small, sometimes transformed into spines, or wanting, (*191*) often pubescent or coriaceous ; root system strongly developed ; the shrublets often take the form of dense cushions).

The communities (associations) formed by these plants are generally very scattered (coverage of the soil-surface less than 50%, often about 10%).

Apart from these plants, desert vegetation is characterized by a sometimes fairly copious development of annual (ephemeral) and perennial, bulbous and rhizomatous (ephemeroid) plants, which vegetate only during the moist period of the year (in warm regions from autumn onwards) and frequently form a continuous turf between the bushes of semi-shrublets and shrubs.

Apart from this, in the constitution of desert vegetation there often take part drought-resistant perennial herbs (of the steppe-grass type) and, in conditions of strong salination of the soil, drought-resistant annuals (often leafless, with succulent green stems).

In Afghanistan the following types (groups of formations) of desert vegetation may be distinguished : A—desert semi-fruticulose vegetation, B—desert semi-fruticose vegetation, C—tragacanth vegetation, D—desert annual-saltwort vegetation.

A. DESERT SEMI-FRUTICULOSE VEGETATION

Occupies vast territories in the southern part of Afghanistan—in the lowlands and on the slopes of mountain ranges up to heights of about 3,200 m. (sometimes even higher) ; to a less extent it is characteristic of northern and south-eastern Afghanistan ; it is widely distributed in the highlands of north-eastern Afghanistan (eastern Badakhshan, Wakhan), as also on the adjacent plateaux and in the valleys of the Pamir. The

following groups of associations may be distinguished : 1—wormwood communities, 2—*teresken* communities, 3—*boyalych* communities, 4—*saxaul* communities, 5—*solonchak*-saltwort communities.

1. Wormwood Communities

Although the species composition of the wormwoods for the various parts of Afghanistan is in the majority of cases unknown, it is possible on the basis of descriptions of the vegetation of adjoining territories to draw some conjectural conclusions regarding the composition and distribution of the wormwood communities, which are composed, as may be established on the basis of a variety of data on Afghanistan, principally of species of the section *Serafidium* [*Artemisia* aff. *cinae* (several species), *A. turanica*, *A. herba-alba*, *A. Skorniakowii*, *A. Lehmanniana*].

1. Pure Wormwood Communities—with the exclusive predominance of wormwoods, mainly of the *A. herba-alba* group, forming a sparse covering with an unimportant proportion of other plants. Probably widely distributed on the saline soils of southern and western Afghanistan, and as small patches entering into the composition of the wormwood-saltwort complexes.

2. Boyalych–Wormwood Communities—with prevalence of wormwoods probably related to *Artemisia cina*, and a considerable proportion of semi-fruticulose saltworts (*boyalych* species—*Salsola arbuscula*, *S. foetida*) and possibly of *saxauls* (*Arthrophytum Griffithii*, *A. salicornioides*). Probably widely distributed on the saline (possibly gypsum-bearing) (*192*) soils of the plains of southern and western Afghanistan, entering into the composition of wormwood-saltwort complexes.

3. Ephemeroid–Wormwood Communities—with a predominance of *Artemisia cina*, *A. herba-alba* and *A. turanica*, with a great share of ephemeroids (*Poa bulbosa*, *Carex pachystylis*) and ephemerals. They probably occur sporadically in northern Afghanistan and especially in the foothills of western and southern Afghanistan.

4. Sand-ephemeroid–Wormwood Communities—with predominance of *Artemisia herba-alba*, and partly of *A. turanica*, with prevalence among the ephemeroids of a sand sedge (*Carex physodes*) and a considerable proportion of feather-grass (*Stipa Hohenackeriana* and *S. Szovitsiana*) and large Umbellifers (*Ferula badrakema*, *Dorema Aitchisoni*). Distributed in southern Turkmenia (Badkhyz) and probably also in northern and western Afghanistan.

5. Tragacanth–Wormwood Communities—with prevalence of wormwoods probably of the affinity of *Artemisia cina* and *A. herba-alba*, and a considerable proportion of tragacanthoid shrublets (species of *Acantholimon*, *Acanthophyllum*, *Astragalus* sect. *Tragacantha*), sometimes with *Eurotia ceratoides* and *Noaea mucronata* and usually with a few ephemerals and ephemeroids. Distributed sporadically in the foothills of northern Afghanistan and probably more widely over the more dry and stony foothills of western and southern Afghanistan.

6. Saxaul–Teresken–Wormwood Communities—with predominance of wormwoods (probably of the *Artemisia cina* affinity), a considerable

proportion of *teresken* (*Eurotia ceratoides*) and *saxaul* (*Arthrophyllum vakhanicum*) and a relatively small proportion of other plants : drought-resistant shrublets (*Atraphaxis*), ephemeroids (*Poa bulbosa*) and ephemerals. Probably occurring sporadically in northern Afghanistan with a considerable distribution in southern Afghanistan and in eastern Badakhshan (as also in the western Pamirs).

7. Feathergrass–Tragacanth–Wormwood Communities—with predominance of wormwoods and a considerable proportion of tragacanthoid shrublets (species of *Acantholimon*) and feathergrass (*Stipa Szovitsiana*) ; among other plants the presence of fruticulose *Astragali* (*A. lasiosemius*, etc.), large Umbellifers (*Ferula schugnanica*, *F. gigantea*, *F. Jaeschkeana*, *Prangos pabularia*), spinose *Cousiniae*, and the perennial herbaceous *Trigonella Griffithii*, is typical. Widely distributed over the rubbly-earthy slopes of the western Pamirs (above 3,000 m.) and probably common in eastern Badakhshan and the highlands of central Afghanistan.

8. Teresken–Wormwood Communities—with predominance of high-mountain stocky semi-fruticulose wormwoods (in the Pamirs *Artemisia Skorniakowii*, *A. Lehmanniana*) and *teresken* (*Eurotia ceratoides*). Sparse communities, extremely poor in composition, common on the high-mountain plateaux of the eastern Pamir, and in Afghanistan probably distributed in Wakhan and on the high dry plateaux of central Afghanistan.

9. Feathergrass–Wormwood Communities—with predominance of the same high mountain wormwoods and an abundance of fine-tufted feather-grasses (*Stipa orientalis*, *S. caucasica*) in the Pamir ; often a considerable share is taken by *teresken* (*Eurotia ceratoides*), tragacanthoid shrublets (species of *Acantholimon*, in the Pamir *A. diapensioides*) and other high-mountain plants (*Trigonella Griffithii*, species of *Oxytropis*, etc.). Common on the rubbly 'slides' [? screes] of the ranges and on the high-mountain plateaux of the eastern Pamir, and probably in Wakhan and the highlands of central Afghanistan.

(193) 2. *Teresken Communities*

The *teresken* (*Eurotium ceratoides*) is widely distributed throughout the whole of Central Asia and is often indicated for Afghanistan. *Teresken* communities are developed, however, within the confines of Central Asia principally on the dry highlands of the Pamir. Judging from this, *teresken* communities probably occur in Wakhan and over the dry highlands of Central Afghanistan.

1. Pure Teresken Communities—with exclusive dominance of *teresken*, are extremely open, with an almost complete absence of other plants, except for crustaceous lichens on the surface of the soil. They probably occur in Wakhan.

2. Saxaul–Wormwood–Teresken Communities—with predominance of *teresken*, a considerable abundance of a *saxaul*-plant (*Arthrophytum vakhanicum*) and wormwood (of the *Artemisia cina* group), and with the presence also of certain herbaceous annuals, shrublets, ephemeroids and ephemerals. Characteristic of the steep southern slopes in the western

Pamir at altitudes of 2000–3000 m., and probably occurring also in eastern Badakhshan and over the foothills of central Afghanistan.

3. Feathergrass–Teresken Communities—with predominance of *teresken* and a finely-tufted feather-grass (*Stipa orientalis*). Distributed on the high-mountain slopes of the Pamir up to 3600 m., and probably occurring in eastern Badakhshan, Wakhan and possibly central Afghanistan.

4. Sedge–Teresken Communities—with predominance of *teresken* and a low-growing (usually 5–15 cm. high), sclerophyllous sedge (*Carex duriusculiformis*), which forms the basis of the lower layer of these communities. Distributed over the steep slopes of the highlands of the Pamir up to 3600 m., and probably occurs also in eastern Badakhshan, Wakhan and central Afghanistan.

3. Saltwort Communities

Characterized by the predominance of a gnarled semifruticulose saltwort, the *boyalych* (*Salsola arbuscula*), with a considerable admixture of other half-shrublets (including wormwoods) ; in the damper regions there is developed in the saltwort communities a lower layer of ephemerals and ephemeroids.

1. Pure Boyalych Communities, with exclusive dominance of *boyalych*, an unimportant share of other half-shrublets (saltworts, wormwoods, *Reaumuria fruticosa*, etc.) and an insignificant part played by ephemerals. Extremely characteristic of the clayey and stony gypsum-bearing soils of the driest level regions of Central Asia (Ust'-urt, Betpak-dala, etc.). Probably distributed over the desert plains of western and southern Afghanistan, occurring in small patches, as one of the basic elements of the wormwood-saltwort complexes.

2. Ephemeroid–Boyalych Communities—with predominance of *boyalych* and a copious development, in the lower layer, of ephemeroids (*Poa bulbosa*, *Carex pachystylis*) and ephemerals (*Eremopyrum Buonapartis*, *Bromus tectorum* and the like). Distributed on consolidated saline sands in south-western Turkmenia, whence they undoubtedly extend into northern Afghanistan.

4. Saxaul-plant communities

Known in southern Tadzhikistan on the earthy-rubbly 'slides' [? screes] of mountains, where they are composed of a semifruticulose *saxaul*-plant (*Arthrophytum leptocladum*) with a dense lower layer of ephemerals (*194*) and ephemeroids. *Arthrophytum leptocladum* occurs also in Iran, and probably in northern Afghanistan, where one may quite probably expect the presence of similar communities, especially in the valley of the Amu-darya river. In southern and western Afghanistan, on the rubbly soils of the foothills and mountain 'slides' [? screes], one may expect *saxaul*-plant communities with other species (*Arthrophytum Griffithii*, *A. salicornioïdes*), but probably without any important development of an ephemeral-ephemeroid layer.

5. *Solonchak-saltwort communities*

Composed principally of semifruticulose saltworts, with fleshy leaves, or almost leafless, with succulent annual shoots.

1. Sarsazan Communities, with predominance of the small half-shrublet *sarsazan* (*Halocnemum strobilaceum*), forming very sparse stands on *solonchaks*. In all probability common in the *solonchak* depressions of the level regions of Afghanistan.

2. Potash-plant Communities, with predominance of a small half-shrublet, the potash-plant (*Kalidium caspicum*), forming sparse stands. Apparently common on the puffy *solonchaks* of the lacustrine hollows of southern and western Afghanistan.

3. Sea-blite Communities, with predominance of the semi-fruticulose small-leaved sea-blite (*Suaeda microphylla*), forming sparse stands, generally in company with other *solonchak* plants (*Aeluropus littoralis* and some saltworts). Apparently common on puffy *solonchaks*, together with potash-plant communities.

B. DESERT SEMI-FRUTICOSE AND FRUTICOSE VEGETATION

Occupies rather considerable tracts on the sands of southern, western and northern Afghanistan ; in part (*Zygophyllum* communities) distributed on the stony slopes of low mountains in the same regions. The following groups of associations may be distinguished : 1—white-*saxaul* communities ; 2—*dzhuzgun* communities ; 3—black-*saxaul* communities ; 4—*Zygophyllum* communities.

1. *White-saxaul communities*

Composed principally of the shrubby (more precisely half-shrubby, since its one-year-old branchlets for the most part fall annually), white *saxaul* (*Haloxylon persicum*), which attains a height of 1·5 2 m. (sometimes more in the case of the arborescent form).

1. Sedge–White-saxaul Communities—with dominance of the white *saxaul* and a predominance in the lower layer of the ephemeroid sand sedge (*Carex physodes*), and with the presence also of numerous ephemerals and ephemeroids (*Allium*, *Tulipa*) ; frequently there also occur here large Umbellifers (species of *Ferula* and *Dorema*), and among other shrubs and half-shrublets—*dzhuzgun* (species of *Calligonum*), astragali (*Astragalus* sect. *Ammodendron*), etc. Extremely likely to occur on the sands of northern Afghanistan, and to a less extent in southern Afghanistan.

2. Wormwood–White-saxaul Communities—with dominance of white *saxaul* in the shrub layer and of wormwood (of the *Artemisia herba-alba* (*lato*) group) in the lower layer ; as regards the remainder of their composition, they differ little from the preceding, but ephemerals and ephemeroids here play a smaller part. Apparently distributed in the south-western part of Afghanistan, since they are indicated by E. G. Chernyakovskaya [15] for the adjoining regions of Iran.

3. Dzhuzgun–White-saxaul Communities—with dominance of white *saxaul* and *dzhuzguns* (numerous species of *Calligonum*), and characteristic sand plants in the lower layers (*Aristida pennata*, *A. Karelini*, *Agriophyllum latifolium*, *Salsola Paulseni*), a few shrubs (species of *Ammodendron*) and half-shrubby astragali (*Astragalus* sect. *Ammodendron*). According to all the data they occur in northern Afghanistan on the blown sands of the Amu-darya, and are probably common on the sands of southern Afghanistan, where the species of *Aristida* are possibly replaced by *Cyperus pungens*, which is indicated for the sands of Registan.

2. *Dzhuzgun communities*

Composed principally of *dzhuzguns* (species of *Calligonum*)—shrubs (more properly half-shrubs) with leafless green shoots and gnarled trunks and branches, readily tolerating burial by sand. On passing to blown (*barkhan*) sand, *dzhuzgun* communities form the stage succeeding the *dzhuzgun*–white-*saxaul* communities. In *Calligonum* communities the white *saxaul*, the "sand acacia" (species of *Ammodendron*), certain astragali (*Astragalus* sect. *Ammodendron*), and *selin* (species of *Aristida*), are common as isolated individuals. In Central Asia *dzhuzgun* communities are very common in the regions where *barkhan* sands predominate, and apparently occur under similar conditions in northern and southern Afghanistan.

3. *Black saxaul communities*

Composed of the black *saxaul* (*Haloxylon aphyllum*), which frequently has a tree-like form, but in which, as in the small desert half-shrublets, a part of the leafless annual shoots falls annually, promoting (owing to the considerable content of water-soluble salts in the cell-sap) the salinification of the superficial layers of the soil beneath the crown of the *saxaul*.

1. Pure Black-saxaul Communities—with dominance of black *saxaul* and almost complete absence of other plants under its canopy, except for certain annual saltworts with a protracted vegetative period (species of *Halimocnemis*, *Salsola*, *Halocharis*, etc.) and some ephemerals (*Lepidium perfoliatum*, *Matricaria lamellata*, etc.). In Central Asia such communities occur on the *takyr*-like saline soils of supra-pratal river terraces; in Afghanistan, their occurrence is possible in south-western Afghanistan and in the region of lake Khamun on the Iran frontier.

2. Wormwood–Black-saxaul Communities—with dominance of black *saxaul* and predominance in the lower layer of wormwood (of the *Artemisia herba-alba* group), sometimes with an admixture of *Zygophyllum fabago*, *Alhagi camelorum* s.l. and a few ephemerals and ephemeroids. It is probable that black *saxaul* communities of this type occur in south-western Afghanistan, since E. G. Chernyakovskaya [15] indicates them for the adjoining regions of Iran.

(196) 4. *Zygophyllum communities*

Composed of a gnarled drought-resistant shrub, zygophyllum (*Zygophyllum atriplicoïdes*), which forms sparse stands on rocky and very stony tracts of mountain slopes on all the southern mountain chains of Central

Asia. Judging by the repeated indications of this species for Afghanistan, it may be assumed that *Zygophyllum* communities are also distributed in Afghanistan, and probably more commonly in its southern part.

C. *TRAGACANTH VEGETATION*

Occupies apparently a rather extensive tract in the mountainous part of Afghanistan. It is characterized by the predominance of so-called tragacanth shrublets—low-growing, many-stemmed "-stooled", much-branched, often spiny plants, forming dense hemispherical "cushions". Characteristic communities composed of such shrublets form a regular feature of the dry highlands of the Pamiro-Alai, Kopet-dagh, Iran and indeed the whole of Nearer Asia. Owing to the lack of data it is difficult to indicate and to give an approximate description of the possible tragacanth communities in Afghanistan, which are undoubtedly very numerous and diverse.

One can only presume the existence among them of tragacanth-sainfoin communities, with dominance of a pulvinate sainfoin (*Onobrychis echidna*), and of tragacanth-*Acantholimon* communities, with dominance of species of *Acantholimon*. The former are probably better developed in western Badakhshan, the latter in eastern Badakhshan and on the central uplands of Afghanistan. Characteristic tragacanth communities also apparently occur in the subalpine zone of the eastern Sefid-kuh, for which the following pulvinate species are indicated: a sainfoin (*Onobrychis cornuta*), an *Acantholimon*, *kachim* (*Gypsophila Stewartii*), a spiny chick-pea (*Cicer pungens*), astragali (*Astragalus* sect. *Tragacantha*), and a shrubby knotgrass (*Polygonum biaristatum*). In central Afghanistan, judging from existing indications as to the distribution here of numerous *Acantholimon* species (Griffith 27, 28), one may assume a particularly wide distribution of *Acantholimon*-tragacanth communities.

D. *DESERT ANNUAL SALTWORT VEGETATION*

Does not occupy extensive tracts, occurring in patches in the *solonchak* vegetation complexes. It is represented by stands of annual fleshy saltworts: Annual Saltwort Communities (generally pure growths of *Salsola crassa*, and probably *S. turcomanica*), Glasswort Communities (generally pure stands of glasswort *Salicornia herbacea*), Gamanthus Communities (generally pure stands of *Gamanthus gamocarpus*). Apparently characteristic of northern, western and southern Afghanistan—in the regions of distribution of saline soils.

HERBACEOUS VEGETATION

Is composed mainly of perennial (more rarely annual) herbs, and has a rather considerable distribution in Afghanistan.

(*197*) In the lower zones of the mountains and on their foothills, owing to the relatively mild winter temperatures, the concentration of precipitation in the winter-spring period, and the prolonged summer droughts, there are developed (sometimes over considerable areas, as for

example in northern Afghanistan) communities consisting chiefly of dwarf ephemerals and ephemeroids, which at the time of their maximum development recall meadows (in the density of herbage, intensity of verdure and softness of the leaves and shoots of the majority of the plants), but are very quickly burnt up with the onset of the summer drought.

In the higher mountain zones, in proportion as the quantity of precipitation increases and the dry season becomes shorter, there is an increase in the abundance of tall herbaceous plants, whose vegetative period is considerably longer than in the low foothills, and hence the communities formed by them are sometimes termed steppes (e.g. " couch-grass–mixed herb steppes " [*p. 199*]). But the complete burning up of this vegetation in summer, and the exceptional abundance, in its composition, of the same ephemerals and ephemeroids as in the lower zones, compel one to compare it for the greater part with the low-growing meadow-like communities of the low foothills, rather than with the steppes.

In the highlands [or high-mountain tracts] (in the subalpine and alpine zones), herbaceous vegetation also plays a rather important part. Here, besides the mountain meadows, there are developed true steppe communities (with dominance of narrow-leaved caespitose grasses) and also communities of characteristic drought-resistant herbaceous perennials and large ephemeroid annuals (principally Umbellifers).

Lastly, herbaceous vegetation accompanies all the river valleys and lake basins. Here meadows of mixed herbaceous plants are common, the plants being to a large extent common to the adjacent territories also.

In Afghanistan it is possible to distinguish the following types (groups of formations) of herbaceous vegetation : A—meadow-like ephemeral vegetation, B—meadow-like ephemeroid vegetation, C—caespitose-grass vegetation, D—sclerophyll–mixed-herb vegetation, and E—meadows.

A. MEADOW-LIKE EPHEMERAL VEGETATION

Is composed principally of dwarf annuals, completely burnt up in the period of drought.

1. Mixed-herb Grass Communities—with dominance of a few species of ephemeral grasses (*Vulpia myuros*, *Aegilops triuncialis*, *Ae. squarrosa*, *Bromus oxyodon*) and "mixed herbage" (*Aphanopleura capillifolia*, *Medicago rigidula*, etc.), with the presence of a large number of other ephemerals (sometimes totalling more than 30 species), and sometimes with a small proportion of perennials (*Poa bulbosa*, *Carex pachystylis*, scattered examples of *Cynodon dactylon*, *Phlomis bucharica*, *Lagonychium farctum*, and a few others). In spring these communities strongly recall meadows in the density of herbage (coverage 70–100 per cent.). They are typical of the southern slopes of the loess foothills of southern Tadzhikistan and are probably widespread under similar conditions in northern Afghanistan.

2. Aegilops Communities—differing from the foregoing in the exclusive dominance of species of *Aegilops* (*Ae. triuncialis*, *Ae. squarrosa*), and in the different composition of the perennials, which also play an unimportant (*198*) part (the more common are *Hordeum bulbosum*, *Codonocephalum*

grande, *Convolvulus subhirsutus*, *Eremurus Olgae* and some others). They are typical of southern Tadzhikistan (generally above 1200 m.), and, judging by indications of the wide distribution of species of *Aegilops*, should be common in northern Afghanistan.

B. MEADOW-LIKE EPHEMEROID VEGETATION

Composed principally of dwarf ephemeroids, vegetating during the wet season of the year and completely dying off in the season of drought. May be divided into : 1—dwarf ephemeroid vegetation, 2—medium ephemeroid vegetation, 3—coarse ephemeroid vegetation.

1. Dwarf ephemeroid vegetation

Composed principally of dwarf ephemeroids, numerous ephemerals and a few coarse perennials and half-shrublets.

1. Ephemeral–Sedge–Meadow-grass Communities—with dominance of a bulbous meadow-grass (*Poa bulbosa*) and a desert sedge (*Carex pachystylis*) and a considerable proportion of ephemerals, few in number of species but numerous in individuals (the commoner being *Trigonella grandiflora*, *Malcolmia turkestanica*, *Alyssum desertorum*, *Papaver pavoninum*, *Delphinium leptocladum*, etc.). On *solonets* soils there are added annual saltworts (*Salsola sclerantha*, *Girgensohnia oppositiflora*), and sometimes also a scattered semi-fruticulose *saxaul* (*Arthrophytum leptocladum*). Such communities are widely distributed in southern Tadzhikistan and (without the *saxaul*) on the skirts of the Kopet-dagh up to a height of 450–500 m., and are apparently extensively developed in northern Afghanistan.

2. Coarse-herb–Sedge–Meadow-grass Communities—in general features very similar to the foregoing, but distinguished by the presence of a sparse primary layer 50–70 (100) cm. in height composed of drought-resisting annual herbs (*Phlomis bucharica*, *Psoralea drupacea*, more rarely *Cousinia polycephala*, *Convolvulus subhirsutus* and some others), sometimes with an admixture of the shrublet *Lagonychium farctum*. Distributed very widely in southern Tadzhikistan over the loess slopes of the foothills from 450 (500) to 800 (1000) m. and probably very common in northern Afghanistan.

3. Sand-sedge Communities—with dominance of a sand sedge (*Carex physodes*), with numerous ephemerals (*Aphanopleura leptoclada*, *Astragalus Korolkowi*, *Delphinium camptocarpum*, *Schismus arabicus*, *Bromus tectorum*, etc.), and a few fruticulose *Astragali* (chiefly *Astragalus confirmans*) ; on the summits of the sandy hillocks the sedge covering is more sparse, while in the upper layer there appear some desert half-shrubs and shrubs (species of *Calligonum*, *Salsola Richteri*, etc.). They are typical of the colonised sands of the south-eastern Karakums on the Afghanistan border and probably of similar sands in the adjoining regions of northern Afghanistan.

(*199*) *2. Medium ephemeroid vegetation*

Composed of tall plants of ephemeroid type, forming a dense upper layer of herbage, and also of ephemerals and ephemeroids composing a dense lower layer.

1. Mixed-herb–Couch-grass Communities ("mixed-herb–couch-grass steppes")—composed basically of the hairy couch-grass (*Agropyrum trichophorum*) and abundant tall mixed herbage (*Codonocephalum grande*, some *Ferulas*, etc.) ; in the lower layer a large part is played by ephemeroids (*Poa bulbosa*, and rather more rarely *Carex pachystylis*) and many ephemerals. Widely distributed on the mountain slopes of all the southern ranges of Central Asia, and, according to Vavilov and Bukinich [3], often met with under similar conditions in northern Afghanistan.

2. Mixed-herb Communities—distinguished from the foregoing by the inconsiderable quantity of hairy couch-grass and the dominance of dicotyledons (*Codonocephalum grande*, *Eremurus Olgae* [1], *Muretia fragrantissima*). Widespread, like the foregoing, but territorially considerably less developed.

3. Coarse ephemeroid vegetation

Composed principally of coarse Umbellifers (*Ferula*, *Prangos*), reaching 100–150 cm. and more in height, and belonging to the peculiar biological group of monocarpics.

1. Kamol Communities—with dominance of *kamol* (*Ferula Jaeschkeana*), a proportion of various perennials (species of *Artemisia*, *Rheum*, *Eremurus*, a number of grasses, including often *Poa bulbosa*) and some ephemerals. Widely distributed in Tadzhikistan, occurring on stony mountain slopes, commencing at 1500–1600 m. and becoming more common in the subalpine zone (up to 3000 m.) ; indicated by Aitchison [17] within the bounds of Afghanistan—in the Sefid-kuh range (eastern) ; possibly occurs also in the Hindukush.

2. Yugan Communities—with dominance of *yugan* (*Prangos pabularia*), in general features similar to the *kamol* communities, but having (in the mountains of Tadzhikistan) sometimes an admixture of some other meadow-type plants (species of *Oryzopsis*, *Bromus turkestanicus*, *Polygonum bucharicum*). According to Vavilov and Bukinich [3] the *yugan* is widely distributed in the Hindukush, its leaves being stored up in large quantities as cattle fodder.

C. CAESPITOSE GRASS STEPPES

Composed principally of perennial caespitose narrow-leaved drought-resistant grasses, chiefly fescue (*Festuca sulcata*) and feather-grass (species of *Stipa*). There often occur also, in considerable abundance, wormwoods and drought-resistant shrublets of the tragacanth type (species of *Acantholimon*, *Onobrychis*, etc.). From the available data, such steppes are widely distributed in the highlands of Afghanistan. By analogy with the adjoining mountain regions of the USSR, and from certain data relating to Afghanistan, one may assume the presence, in the high-mountain zone of the Afghan highlands (the Hindukush and other ranges of central Afghanistan, and also Badakhshan), of the following basic communities of caespitose-grass steppes.

(*200*) 1. Mixed-herb–Fescue Steppes—with dominance of fescue and abundance of mixed herbage (*Geranium Regelii*, *Potentilla sericata*, *Polygonum bucharicum*, *Nepeta podostachys*, etc.) and some grasses (*Agropyrum ugamicum*, *Phleum phleoides*). Commonly occurring on northern earth slopes.

2. Feathergrass–Fescue Steppes—with dominance of fescue and a considerable proportion of feathergrass (in Tadzhikistan *Stipa kirghisorum*, *St. orientalis*, *St. caucasica* and some others) ; mixed herbage less abundant (the more common species are *Geranium Regelii*, *Nepeta podostachys*, etc.). Occurring on the drier earth slopes.

3. Cousinia–Fescue Steppes—with dominance of fescue, a considerable proportion of a spiny alpine *Cousinia* (*C. Francheti*), and mixed herbage showing little variety (*Geranium Regelii*, *Arenaria turkestanica*, *Polygonum biaristatum*). Occurring on earth slopes principally in the alpine zone.

4. Tragacanth–Fescue Steppes—with dominance of fescue and a proportion of pulviniform ('tragacanthoid') shrublets (chiefly *Acantholimon*, some *Astragali*, *Onobrychis echidna* and *O. cornuta*), and also semifruticulose wormwoods and some feather-grasses (*Stipa caucasica*, etc.). Occurring on dry rubbly slopes in the high-mountain region.

5. Wormwood–Fescue Steppes—with dominance of fescue and a considerable proportion of dwarf semi-fruticulose wormwood (on the Pamirs *Artemisia Lehmanniana* and more rarely *A. Skorniakowii*) ; the remaining plants are few. Occurring on the driest rubbly slopes of the high-mountain region.

6. Yugan [Prangos]–Sheep's-fescue Steppes—with dominance of a non-disarticulating sheep's-fescue (*Festuca spadicea*) and a proportion of coarse Umbellifers (*Prangos pabularia*, *Pyramidoptera cabulica*, species of *Dorema* and *Ferula*). According to Vavilov and Bukinich's [3] data they occur on the high-mountain *massifs* of central Afghanistan.

D. SCLEROPHYLL–MIXED-HERB VEGETATION

Composed of coarse, sclerophyllous, perennial-herbaceous, drought-resisting plants with stout woody roots. Here belong the *Cousinia* communities (with dominance of species of *Cousinia*), referred by some authors, together with the Tragacanth communities, to the general group of "highland xerophytes". The *Cousinia* communities are widely distributed in the subalpine and alpine zones of the Pamiro-Alai, and according to the data available (Griffith [27, 28], Aitchison [17, 18], Haeckel & Troll [29]) are common in the high-mountain tracts of Afghanistan also, being composed here of other species than in the Pamiro-Alai.

1. Subalpine Cousinia Communities—with dominance of any one of the species of *Cousinia* (in the southern Pamiro-Alai *Cousinia stephanophora*, *C. splendens*, *C. macilenta*, *C. Fedtschenkoana*, *C. trachyphylla*), and sometimes with an admixture, on the northern slopes in the lower part of the subalpine zone, of certain mountain-meadow plants (*Polygonum bucharicum*, *Alopecurus seravschanicus*, *Bromus turkestanicus*, etc.), and also of common high-mountain species (*Geranium Regelii*, *Arenaria Griffithii*, etc.) ; spiny fruticulose *Astragali* of the type of *A. lasiosemius* are also common in the *Cousinia* communities. Judging from Griffith's [27, 28] data, these are widely distributed on the high-mountain *massifs* of central Afghanistan ;

(*201*) in the Sefid-kuh range (eastern), there are indicated by Aitchison [17, 18], likewise in the alpine zone, *Cousinia racemosa*, *C. elegans*, *C. carthamoides*, which are here in places the dominant plants.

In the southern Pamiro-Alai, subalpine *Cousinia* communities are distributed principally on rubbly soils at altitudes between 2500 (2600) and 2800 (3100) m. above sea-level. Under the same conditions they may be expected in Afghanistan also.

2. Alpine Cousinia Communities—with dominance of high-mountain alpine species of *Cousinia* (in southern Pamiro-Alai *Cousinia Francheti* and *C. pannosa*, in Afghanistan—Nuristan—the related *C. Trollii* and *C. xanthophoenicea*), and a few, inconstant, other plants (in Pamiro-Alai the more common are *Oryzopsis alpestris*, *Nepeta podostachys*, *Geranium Regelii*, *Poa bucharica* and some others). In Pamiro-Alai, alpine *Cousinia* communities are likewise widespread, principally on rubbly soils, above 3200 m. above sea-level (in the southern part up to 3500 m.) ; and they are probably developed in Afghanistan also in similar conditions.

E. MEADOWS

Composed principally of perennial mesophytic herbs. Distributed in Afghanistan in the mountains, where there are sufficient precipitations or snow-waters, and in plain-like conditions—in stream valleys and lake-hollows. They may accordingly be divided into : 1—mountain meadows, and 2—lowland meadows.

1. Mountain meadows

Distributed over moist localities in the high mountains (in the subalpine and alpine zones), for the most part not occupying large continuous areas, but occurring in small patches, in hollows, in high-mountain valleys and on slopes moistened by snow-waters, principally on earth soils. May be divided into : a—low-herbage meadows, and b—medium-herbage meadows.

a. Low-herbage meadows

Developed chiefly on earth soils in the alpine zone, reaching to the upper limits of distribution of the higher plants. Composed of low-growing herbaceous plants often not exceeding 3–5 cm. in height.

1. Mixed-herbage-and-grass Meadows—with dominance of low-growing grasses and rich mixed-herbage. In southern Pamiro-Alai they are represented by mixed-herbage-and-*Atropis* meadows (with dominance of *beskilnits—Atropis subspicata*) and mixed-herbage-and-meadow-grass meadows (with dominance of Karategin meadow-grass—*Poa karateginensis*) ; in the mixed-herbage, *Oxytropis savellanica*, *Potentilla gelida*, *P. flabellata*, *Gnaphalium supinum*, *Cerastium cerastoides*, and many others, are usually very abundant ; the main mass of the herbage normally does not exceed 2–5 cm. in height. Such meadows probably occur in small patches over the highlands of northern and central Afghanistan (the " lawns " of Griffith [27, 28]).

2. Mixed-herbage Meadows—with preponderance of dwarf dicotyledons, in southern Pamiro-Alai *Oxytropis savellanica*, to which are sometimes added *Atropis subspicata*, species of *Cerastium*, *Ranunculus turkestanicus*, (*202*) species of *Potentilla*, *Gagea*, *Draba*, etc. ; the main mass of the herbage is between 3 and 5 cm. in height (individual plants reach 30–50 cm.). Similar meadows are probably distributed also through Afghanistan, where, for example, for the Sefid-kuh (eastern) Aitchison [17, 18] indicates in the alpine zone (above 3700–4000 m.) astragalus "carpets" (*Astragalus* aff. *conferta*), and growing in the same place *Delphinium Brunonianum*, *Rheum Moorcroftianum*, *Bupleurum* sp., and *Oxygraphis Shaftoana*, and at higher altitudes *Potentilla monanthes*, *P. sericea*, and *Draba* sp.

3. Cobresia Meadows—with dominance of low-growing (10–20 cm.) Cobresias, in the Pamiro-Alai *Cobresia pamiroalaica*, with an admixture of *Potentilla flabellata*, *Atropis subspicata*, *Cerastium cerastoides*, *Gnaphalium supinum*, etc., developing in conditions of temporary surplus moisture.

Such meadows probably occur also in Afghanistan—apparently in Badakhshan and Wakhan. Apart from this, *Cobresia capillifolia* (*C. scirpina* according to Aitchison 17, 18 and other authors) and *C. Royleana* (recorded to the north of Kabul at heights of 3000–4000 m. under the name *C. stenocarpa*) occur in Afghanistan.

4. Sedge Meadows—with dominance of low-growing sedges, forming a dense herbaceous covering in conditions of temporary or permanent surplus moisture. In southern Pamiro-Alai they are composed of *Carex orbicularis* and *C. pseudofoetida*, which form the main mass of the herbage (8–15 20 cm. in height), with a small admixture of *Blysmus compressus*, *Trifolium repens*, *Cerastium*, etc. In southern Pamiro-Alai the subalpine sedge meadows are composed of *Carex melanantha*. It is probable that similar sedge meadows occur also in Afghanistan, since all the sedges mentioned are recorded thence.

b. Medium-herbage meadows

Distributed mainly on earth soils in the subalpine zone. Composed principally of tall-growing herbaceous plants, reaching a height of 60–100 cm. or more.

1. Mixed-herbage-and-grass Meadows—with dominance of perennial meadow grasses and a considerable admixture of mixed herbage. In southern Pamiro-Alai they are represented by mixed-herbage-and-foxtail meadows (with *Alopecurus seravschanicus*), mixed-herbage-and-couchgrass meadows (with *Agropyrum ugamicum*), mixed-herbage-and-brome meadows (with *Bromus turkestanicus*), and cocksfoot meadows (with *Dactylis glomerata*) ; of other grasses the more common are *Oryzopsis lateralis*, *Poa bucharica*, etc. ; in the mixed herbage the principal rôle is played by *Polygonum bucharicum*, *Geranium Regelii*, *Senecio songoricus*, *Nepeta podostachys* and many others ; the herbage is dense and tall (main mass 30–60 cm., first layer [storey] 70–100 cm., individual plants up to 150 cm.).

Similar meadows probably occur also in Afghanistan, since *Agropyrum*, *Alopecurus* and *Bromus* (species not indicated) are repeatedly cited by various authors ; in addition, *Oryzopsis Vavilovi* (related to *O. lateralis*) is widespread on mountain meadows in Afghanistan, and meadows are known composed of *Hordeum violaceum* (Vavilov and Bukinich [37]) and *Pennisetum* (possibly *P. lanatum*). Apparently the most characteristic mountain meadows of Nuristan are composed of *Themeda anthera* and *Andropogon contortus*.

2. Mixed Herbage Meadows—with dominance of tall herbaceous (*203*) dicotyledons. In southern Pamiro-Alai, in the alpine and subalpine zone, represented by *Polygonum* meadows, with dominance of *Polygonum* (*P. bucharicum* up to 100–150 cm. tall or *P. hissaricum* up to 40–50 cm. tall), with an admixture of *Alopecurus seravschanicus*, *Poa bucharica*, *Oryzopsis molinioïdes*, species of *Astragalus*, *Nepeta podostachys*, *Psychrogeton cabulicus*, *Geranium Regelii*, *Euphorbia seravschanica*, on rubbly slopes sometimes *Ferula Jaeschkeana*, *Prangos pabularia*, *Arenaria Griffithii* and occasionally *Cousinia Francheti* and *C. acicularis*. In addition, there are known *Allium* meadows with a dominance of *Allium monadelphum* and an admixture of alpine mixed herbage : *Draba Olgae*, *Potentilla gelida*, *Gnaphalium supinum*, *Cerastium cerastoides*, *Polygonum bistorta*, *Oxytropis savellanica*, etc. In Afghanistan, meadows with the same or similar composition are probably distributed also in the subalpine or alpine zones, judging by the indications for Afghanistan generally of *Polygonum bucharicum* (*Flora USSR* **5**), for the subalpine zone of eastern Sefid-kuh of *Polygonum rumicifolium* (Aitchison [17]), and for Badakhshan and Nuristan of *Allium* meadows.

3. Lyme-grass Meadows—with dominance of lyme-grass (*Elymus dasystachys*). Distributed over the river valleys of the Pamir. Probably occur in adjacent Wakhan and Badakhshan, where Vavilov and Bukinich [3] repeatedly indicate *Elymus* at altitudes of 4000 m.

2. *Lowland meadows*

Distributed only under conditions of constant subsoil moisture—along stream valleys and in lake depressions—and, as secondary communities, along irrigation canals in oases. Composed principally of meadow and marsh grasses and, in conditions of constant surplus moisture, of reed-maces [*Typha*], club-rushes [*Scirpus*] and rushes [*Juncus*]. May be divided into : a—low-herbage meadows, b—medium-herbage meadows, and c—tall-herbage meadows.

a. Low-herbage meadows

Composed of low grasses often forming almost pure stands.

1. Azhrek Meadows—with dominance of *azhrek* (*Aeluropus littoralis*). Distributed on *solonchaks* and in the lake-hollows of western and southern Afghanistan.

2. Bermuda-grass Meadows—with dominance of Bermuda-grass (*Cynodon dactylon*). Indicated (Vavilov and Bukinich [3]) for northern Afghanistan, where it is distributed (as also in southern Tadzhikistan) not only along the river valleys but on the fairly dry slopes of loess hills ; known also in the Dzhelalabad valley.

b. Medium-herbage meadows

Composed of fairly coarse (70–100 to 150–200 cm. tall) grasses and some dicotyledons.

1. Reed-grass Meadows—with dominance of reed-grass (*Calamagrostis dubia* and other species). Distributed in the flood-plain of the Amu-darya river in northern Afghanistan.

2. Kzyl-kiyak Meadows—with dominance of *kzyl-kiyak* (*Imperata cylindrica*) and frequently an admixture of *Phragmites communis*, *Glycyrrhiza glabra*, (*204*) *Erianthus purpurascens*, *Melilotus albus*, etc., and isolated shrubs (often *Elaeagnus angustifolia*). Flood-plain of the Amu-darya river and probably of some other rivers of Afghanistan.

3. Sugar-cane Meadows—with dominance of sugar-cane (*Saccharum spontaneum*) and an admixture of *Phragmites communis*, species of *Calamagrostis*, *Erianthus purpurascens*, *Imperata cylindrica*, isolated bushes of *Elaeagnus angustifolia* and *Tamarix ramosissima* and small trees of *Populus euphratica*. Flood-plain of the Amu-darya river and river valleys of southern Afghanistan.

In the Dzhelalabad valley *Saccharum spontaneum* is replaced by *S. ciliare*, which is cited as one of the characteristic plants of the Kabul river valley.

For the river valleys of southern Afghanistan are recorded in addition pure stands of *polevichka* (*Eragrostis cynosuroïdes*) and lemon sorghum (*Andropogon laniger*).

4. Mixed-herbage Meadows—with dominance of *solodka* (*Glycyrrhiza glabra*), commonly with a small admixture of *Erianthus purpurascens*. Flood-plain of the Amu-darya river, and probably of other Afghan rivers ; sometimes on the river-facing slopes of loess hills.

5. Marsh Medium-herbage Meadows—with dominance of marsh plants, forming : Reed-mace Communities, composed generally of one of the following species of reed-mace—*Typha latifolia*, *T. angustifolia*, *T. minima*, *T. elephantina* ; Rush Communities, composed chiefly of the rush *Juncus maritimus*; and Club-rush Communities, formed of the club-rush *Scirpus maritimus*. Very wet portions of river valleys and lake hollows.

c. Tall-herbage meadows

Composed of tall (2 to 5–6 m. high) grasses, with a small admixture of dicotyledons.

1. Reed Communities—with dominance of the common (*Phragmites communis*) or Spanish (*Arundo donax*) reed. The valley of the Amu-darya, and also of other rivers ; occupying extensive areas in the lake basins of south-western Afghanistan (*Phragmites communis*).

2. Lukh Communities—with dominance of *lukh* (*Erianthus purpurascens*) and an admixture of *Imperata cylindrica*, *Phragmites communis*, *Glycyrrhiza glabra*, *Alhagi camelorum*, s.l., *Aeluropus littoralis*, *Saccharum spontaneum*, bushes of *Elaeagnus angustifolia* and *Tamarix ramosissima*. Valleys of the Amu-darya, Herirud and probably a number of other rivers. *Lukh* communities are indicated also (Vavilov and Bukinich [3]) in the basin

of the Murgab river in northern Afghanistan, on pure loess hills, in the same way as is occasionally observed in southern Tadzhikistan.

For the valley of the Kabul river (within the bounds of the Dzhelalabad depression) is indicated a second species of *lukh*—*Erianthus fulvus*, probably also forming analogous communities.

TREE AND SHRUB VEGETATION

Tree and shrub vegetation is not of wide extent in Afghanistan. Only in Nuristan and the Sefid-kuh does forest and scrub form a characteristic element in the landscape. (*205*) In the remainder of Afghanistan it is developed only along the river-valleys, and much more rarely on mountain slopes (more frequently in northern Afghanistan).

Zon and Sparhawk—the authors of the American manual *Forest Resources of the World* [35], published in 1923—estimate the degree of forest cover of Afghanistan as 1·5 per cent., giving at the same time for Central Asia, well known for its slight forest cover, the figure of 14·7 per cent., *i.e.*, ten times greater. Despite the evident unreliability (owing to insufficient material) of these figures, it may be that they do to some extent correspond to the factual position.

According to the data available in the literature, the tree and shrub vegetation of northern Afghanistan approaches very closely in its composition to that of southern Central Asia. In Nuristan and in the Sefid-kuh there is developed quite typical forest and scrub, in common with north-west India, and closely recalling in composition and character the tree and shrub vegetation of the moist parts of the Mediterranean.

The tree and shrub vegetation of Afghanistan may be vivided into : A—coniferous forests, B—deciduous forests, C—scrub communities.

A. CONIFEROUS FORESTS

The coniferous forests of Afghanistan are composed on the one hand of fairly moisture-loving, needle-leaved types—pines, fir, spruce and cedar, and on the other of drought-resistant, scale-leaved, arborescent junipers. Consequently they may be divided into two groups : 1—moisture-loving (needle-leaved) forests, and 2—drought-resistant (scale-leaved) juniper forests.

1. Moisture-loving (needle-leaved) forests

Concentrated exclusively in the northern part of Afghanistan on the frontier with north-west India. Composed of 5 principal coniferous species : Gerard's pine (*Pinus Gerardiana*), Himalayan pine (*Pinus excelsa*), Himalayan fir (*Abies Webbiana*), Smith's spruce (*Picea Smithiana*) and Himalayan cedar (*Cedrus deodara*).

1. Gerard's-pine Forests—with dominance of Gerard's pine (*Pinus Gerardiana*)—a tree up to 25 m. high and 3 m. in diameter—growing generally in separate groups on steep stony slopes, at altitudes of 1800–3300 m. above sea level. Nuristan, Sefid-kuh (eastern), north-west India, Beluchistan (southwards to the Suleiman mountains).

2. Himalayan-pine Forests—with dominance of Himalayan pine (*Pinus excelsa*), a large tree up to 45 m. high and more than 3 m. in diameter—distributed on less dry slopes than Gerard's pine, at between 1800 and 3500 m. altitude above sea level. Nuristan and Sefid-kuh (eastern), southwards apparently only to the upper reaches of the Gumal river.

3. Cedar–Pine Forests—with dominance of Himalayan pine (*Pinus excelsa*) and the Himalayan cedar (*Cedrus deodara*). These forests probably have a rich tree-shrub layer, and at the lower limits of their distribution an evergreen oak (*Quercus baloot*) takes part in their composition. Distributed at altitudes between 2000 and 3000 m. above sea level. Nuristan and Sefid-kuh (eastern); in the Sefid-kuh *Quercus baloot* is replaced above 2600 m. by another species—*Q. semecarpifolia*.

(206) 4. Cedar–Spruce Forests—with dominance of Smith's spruce (*Picea Smithiana*), and also of cedar (*Cedrus deodara*) and fir (*Abies Webbiana*); the yew (*Taxus baccata*) is probably present also.

The spruce and the fir attain gigantic dimensions (up to 60 m. in height and 6 m. in diameter) and form the basis of massive dense forests developed on the moister shaded northern and western slopes. Undergrowth in them is probably weakly developed, and here apparently are referable Griffith's [27, 28] indications of a poor herbaceous covering of ferns and a few dicotyledons (*Alliaria*, *Anemone*, *Viola*, *Thalictrum*, *Fragaria*, *Urtica*); for the similar forests of the Sefid-kuh the following ferns are mentioned by Aitchison [17, 18]: *Asplenium viride*, *Cystopteris fragilis*, *Nephrodium barbigerum*. In the lower zone of distribution of these forests, among the conifers appear an oak (*Quercus baloot*), a maple (possibly *Acer oblongum*) and deciduous shrubs. Such forests are distributed in Nuristan and the Sefid-kuh.

5. Fir Forests—with dominance of the Himalayan fir (*Abies Webbiana*)—a large tree reaching 45 m. in height and 10 m. in diameter. In the underbrush a birch (*Betula utilis*) and a rhododendron (*Rhododendron campanulatum*) are common. These forests are distributed in Nuristan and the Sefid-kuh between 3000 and 3300 m. altitude.

6. Cedar Forests—with dominance of Himalayan cedar (*Cedrus deodara*), the presence of an evergreen oak (*Quercus balooi*) and a rich shrub layer of *Berberis*, *Cotoneaster*, *Lonicera*, *Rosa*, *Clematis montana*, *Salix elegans*, etc. Distributed in Nuristan and the Sefid-kuh, principally between 1800 and 2400 m. altitude.

In the majority of cases no data are available on the nature of the shrub and herb layers of the different types of coniferous forests, and hence it is only possible to give the most general summaries.

For light woodlands, there is indicated a preponderance of grasses in the herbaceous covering; this probably belongs to the Himalayan-pine and cedar–pine forests.

Of shrubs, in the zone of dominance of coniferous forests, the following are indicated: *Spiraea* sp., *Crataegus* sp., *Sophora mollis*, *Cotoneaster* sp., *Daphne oleoïdes*, *Ribes orientale*, *R. grossularia*, *Lonicera Griffithii*, *Fraxinus xanthoxyloïdes*, etc. The majority of these shrubs probably occur in the lighter Himalayan-pine, cedar–pine and cedar forests.

2. Drought-resistant (scale-leaved) juniper forests

Distributed partly in eastern Afghanistan, on dry slopes amongst moisture-loving coniferous forests, but principally in south-eastern and northern Afghanistan. Composed of two principal species of arborescent juniper : *Juniperus seravschanica* and *J. excelsa**.

1. Juniper Communities of Northern Afghanistan—composed of the Seravshan juniper (*Juniperus seravschanica*), reaching 5-10 m. in height, and forming for the most part light open populations. Under the light canopy of the juniper an important rôle is often played by the shrubs : (*207*) *Berberis*, *Lonicera*, *Rosa* ; the herbaceous covering usually has no specifically woodland species, except on the shaded earth slopes, where the juniper forms denser populations (plant-cover ['completeness'] about 0·9), and under its canopy appear some shade-loving species (*Poa nemoralis*, *Senecio songoricus*). Widely distributed on the dry stony slopes of northern Afghanistan.

2. Juniper Communities of Southern Afghanistan—composed of the tall juniper (*Juniperus excelsa*), reaching a height of 20 m. According to the indications of Elwes and Henry [26], in north-eastern Afghanistan (and Beluchistan) this juniper forms sparse open woodlands, apparently recalling the north Afghan juniper communities.

B. DECIDUOUS FORESTS

Distributed for the most part along river valleys (walnut, birch, poplar and olive woods), and on mountain slopes (birch in the high-mountain tracts, maple, oak in Nuristan and the Sefid-kuh, almond, pistachio, judas-tree and *karkas* [*Celtis*] woods).

1. Birch Woods—known in the Pamir, where they are represented along river valleys by small patches of populations composed of *Betula schugnanica* ; probably distributed also in Badakhshan. The birch-woods of *Betula utilis*— a tree reaching a height of 18 m. under optimum conditions—in the highlands of the Sefid-kuh are composed of small trees and even bushes of this birch, usually accompanied by *Rhododendron campanulatum*. These birch-woods apparently occur also in Nuristan.

2. Walnut Woods—of Greek walnut (*Juglans regia*), a large tree up to 10–15 m. in height—occur in Nuristan and the Sefid-kuh, and also probably in western Badakhshan, and represent dense shady populations with a plant-cover ['completeness'] of 0·7–0·8, sometimes with underbrush of shrubs (*Cotoneaster*, *Crataegus*, *Lonicera*, *Rosa*) and low trees (*Acer*, *Prunus*, *Populus*). In the southern Pamiro-Alai (and probably in Badakhshan) the herbaceous covering in these woodlands is sparse, commonly consisting of *Poa nemoralis*, *Impatiens parviflora*, *Alliaria officinalis*, *Origanum tytthanthum*, *Senecio songoricus*. In the underbrush of the walnut woods of the valleys of the Sefid-kuh there are indicated : *Euonymus fimbriatus*, *Rhamnus purpureus*, *Staphylea emodi* and *Syringa emodi*.

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*The true *Juniperus excelsa* M.B. does not occur in Afghanistan and Beluchistan, though it is cited by a number of authors ; hence, pending special investigation, this name is adopted provisionally.

3. Maple Woods—of the Turkestan maple (*Acer turkestanicum*), a tree up to 10 m. high—are apparently developed in western Badakhshan, where by analogy with the southern Pamiro-Alai they may be expected on the northern slopes of the mountains, and as there with a proportion of *Juglans regia* (sometimes), *Juniperus seravschanica*, *Acer pubescens*, *A. Fedtschenkoanum*, and a number of shrubs such as *Fraxinus raibocarpa*, *Rosa lutea*, *Lonicera persica*, *Cotoneaster racemiflora*, etc., and a herbaceous covering of *Dactylis glomerata*, *Poa nemoralis*, *Aegopodium podagraria*, etc. It is possible that maple woods (probably with *Acer oblongum*) occur also in Nuristan.

4. Poplar Woods—distributed exclusively along the river valleys. In eastern Badakhshan they probably consist of the Pamir poplar (*Populus pamirica*) ; in the conditions of the central mountains of other parts of Afghanistan, of *Populus laurifolia* and *P. alba*. In the river valleys of the plains are developed woods of *turanga* (*Populus euphratica*), consisting partly of the so-called "*tugai* woods" ; common species in their composition are *Elaeagnus angustifolia* and *Tamarix ramosissima*, and in the herbaceous covering (*208*) the common plants of the valley meadows, with the addition, under conditions of considerable soil salinity, of *Aeluropus littoralis* and some Chenopods (*Salsola dendroïdes*, *Halocharis hispida*, etc.).

5. Oak Woods—occur exclusively in eastern Afghanistan (in Nuristan and the Sefid-kuh). The basic species is an evergreen oak (*Quercus baloot*)—a large tree with stiff spiny leathery leaves—distributed between altitudes of 900 and 2600–2700 m., but forming forests between 1200 (1500) and 2400 m. Low down the woods are light and sparse, but higher up they have the appearance of dense thickets, with ivy (*Hedera helix*) climbing on the trees, and dense underbrush, in Nuristan consisting of *Fraxinus xanthoxyloïdes*, *Amygdalus kuramica*, *Lonicera arborea*, *Cotoneaster Lindleyi* (?), *Sambucus adnata* and *Daphne oleoïdes*.

In the Sefid-kuh in the zone of oak woods are indicated : *Cotoneaster bacillaris*, *Jasminum officinale*, *J. revolutum*, *Lonicera Griffithii*, *L. quinquelocularis*, *Rhamnus purpureus*, *Rh. dahuricus*, *Rosa Webbiana*, *R. moschata*, *R. Ecae*, *Amygdalus kuramica*, *Abelia triflora*, *Smilax vaginata*, *Dioscorea deltoïdes*, *Viburnum cotinifolium*, *Sophora mollis*, *Daphne oleoïdes*, *Padus racemosa*, *Fraxinus xanthoxyloïdes*.

It is possible that a number of the shrubs enumerated both in the Sefid-kuh and in Nuristan form independent stands, not under the canopy of forest.

6. Pomegranate Communities—occur in eastern Afghanistan (Nuristan and Sefid-kuh), and also in western Badakhshan. Represented by small stands of pomegranate (*Punica granatum*) on the stony terraces of river valleys. The pomegranates here have almost the form of trees, reaching a height of 5 m.

7. Almond Communities—composed of the tree-like or shrub-like Bokhara almond (*Amygdalus bucharica*)—represent light populations with plant-cover of 0·2–0·5, usually with a proportion of certain other trees and shrubs such as *Crataegus pontica*, *Lonicera persica*, *Cotoneaster racemiflora*, sometimes *Juniperus seravschanica*, *Acer pubescens* and *A. Fedtschenkoanum*, and with a herbaceous covering not differing in composition from the

herbaceous vegetation prevalent at these altitudes (usually ephemeral-ephemeroid). By analogy with the southern Pamiro-Alai such almond communities should be expected in northern Afghanistan, particularly, no doubt, in western Badakhshan.

In eastern Afghanistan (Nuristan and Sefid-kuh) small woods of *Amygdalus kuramica* are probable.

8. Pistachio Communities—formed by two species of pistachio, usually not forming mixed populations : the true pistachio (*Pistacia vera*) and the Kabul pistachio (*P. cabulica**). Pistachio communities of *Pistacia vera* occur on the loess hills of the foothill region and on the stony slopes and summits of low mountains, at altitudes between 600 (800) and 1800 (2000) m. above sea-level. The individual specimens of pistachio, usually low (4–5 m.), crooked trees with a hemispherical crown, grow very sparsely, giving the pistachio communities a park-like character. The herbaceous covering in the pistachio communities consists chiefly of ephemerals and ephemeroids, and scarcely differs from the vegetation of the surrounding open country. These pistachio communities are distributed in greater or less (*209*) degree over the whole of northern Afghanistan, immediately abutting to the east on the extensive pistachio communities of southern Tadzhikistan.

Pistachio communities of *Pistacia cabulica* occur under the same conditions, in general, as the preceding, forming populations of exactly the same character, but distributed further south—in southern Afghanistan (for example between Girishk and Farakh), and also in eastern Afghanistan—to the east of Kabul and in the adjoining parts of Beluchistan.

9. Judas-tree Communities—light sparse populations of the Judas tree or Griffith's Cercis (*Cercis Griffithii*), distributed on the stony slopes of low hills at altitudes between 800 (1200) and 1500 (1800) m. above sea-level. According to all the data it must have a considerable distribution in northern Afghanistan.

10. Karkas Communities—light sparse populations of the Caucasian *karkas* (*Celtis caucasica*), developed usually on the stony screes of the southern slopes of low hills. They probably occur in northern and eastern Afghanistan.

C. SCRUB COMMUNITIES

Distributed chiefly in the river valleys, but playing a large part also on the mountain slopes amongst woods, and sometimes in the highlands (in the subalpine zone). May be divided into : 1—scrub communities of the river valleys, and 2—scrub communities of the mountain slopes.

1. Scrub communities of the river valleys

In the river valleys of the dry low-lying regions of Afghanistan, among scrub communities there is a predominance of dense Tamarisk Scrub, consisting of *Tamarix ramosissima, T. hispida* and a number of other species, e.g., *T. tetragyna, T. tetrandra, T. dioica, T. articulata* (frequently arborescent,

*Vavilov and Bukinich [3] cite this under the erroneous name *Pistacia khinjuk*.

up to 4 m. high) ; among other shrubs common here are *Lycium ruthenicum*, *Vitex pseudonegundo*, and, in the extreme south of Afghanistan, the oleander also—*Nerium odorum* ; in the herbaceous covering there is often a preponderance of *solonchak* plants : *Aeluropus littoralis*, *Salsola crassa*, *Statice otolepis*, *Halocharis hispida*, *Karelinia caspica* and *Schanginia baccata*, and also *Clematis orientalis*, *Cynanchum acutum* and *Eragrostis cynosuroides* in the south. Oleander Scrub (*Nerium odorum*), besides being known from southern Afghanistan, is indicated also in the east—in the Dzhelalabad valley along the Kabul river. Willow Scrub (stands of various species of *Salix*) is very characteristic of the montane and highland stream valleys, as also is Sea Buckthorn Scrub (*Hippophaë rhamnoïdes*).

2. Scrub communities of mountain slopes

Distributed principally in the middle parts of the mountain slopes in the moister regions of Afghanistan, mostly on stony slopes amongst woodland communities, partly in the subalpine zone. Among the latter must be noted Juniper Scrub, distributed in Nuristan and the Sefid-kuh from 3000 to 4000–4100 m. altitude, composed of prostrate bushes of *Juniperus sibirica* and forming a characteristic element in the high-mountain landscape.

In the subalpine zone of the Sefid-kuh there is also distributed Willow–Rhododendron Scrub, formed by shrubby (*210/211*) rhododendrons (*Rhododendron Collettianum* and probably also *R. campanulatum*) and willows (*Salix grisea*, *S. elegans*), with an admixture of some further shrubs such as *Ribes rubrum*, *R. grossularia*, *Juniperus sibirica*, and coarse perennials such as *Polygonum rumicifolium*.

Very characteristic, apparently, of the intermediate mountain zones of northern and, in part, southern Afghanistan are dense thickets of roses (various species of *Rosa*), or "Rosaries" [Rose Communities] ; in the mountainous regions of Tadzhikistan adjoining northern Afghanistan these are formed of *Rosa lutea*, with a very small admixture of individual examples of larger shrubs and trees, such as *Lonicera persica*, *Cotoneaster* (1–2 species), *Acer turkestanicum*, and *Juniperus seravschanica*, with a dense herbaceous covering of *Polygonum bucharicum*, *Agropyrum ugamicum*, *Nepeta podostachys*, *Poa nemoralis*, etc. At the upper limits of distribution of the Tadzhikistan rose communities, *Rosa lutea* is replaced by *Rosa Ecae*, originally described from the Sefid-kuh. In eastern Afghanistan it is possible that there occur analogous communities of the there widespread *Rosa Webbiana*, *R. moschata* and *R. Ecae*.

In analogous conditions there is sometimes developed Cotoneaster Scrub (1–2 species of *Cotoneaster*), with the same herbaceous cover as in the rose communities, and an admixture of individual examples of *Rosa lutea*, *Colutea persica*, *Crataegus turkestanica* and *Acer turkestanicum*.

Small tracts of scrub on dry stony slopes at altitudes between 1200 and 1800 m. are probably formed, in northern and eastern Afghanistan, by *Paliurus spina-Christi*, *Rhus coriaria* and *Zizyphus sativus*, which are recorded from Afghanistan.

In the Sefid-kuh (eastern) there are indicated, on southern slopes, at altitudes of 1200–1500 to 2300 m., scrub communities of *Daphne oleoides*, *Sophora mollis*, species of *Cotoneaster*, *Rhamnus persica*, *Cotinus coggygria*,

Syringa persica, and *Caragana brevissima*, among which are scattered pistachio trees—*Pistacia khinjuk* [but cf. note to p. 206] and *P. cabulica*.

Typical scrub communities are characteristic of the slopes and low eminences of the Dzhelalabad valley, and of the low hills of the Sefid-kuh and of the ranges of southern Nuristan up to a height of about 1200 m. above sea-level. In the composition of these thickets a whole series of shrubs are recorded, among which must be mentioned : *Periploca aphylla*, *Acacia modesta*, *Dodonaea viscosa*, *Polygonum* sp., *Amygdalus* sp., *Cerasus* sp., *Celtis caucasica*, *Terminalia bellerica* (?), *Buddleja paniculata*, *Roylea elegans*, *Ficus carica*, *Gymnosporia Royleana*, *Withania coagulans*, *Adhatoda vasica*, *Reptonia buxifolia*, *Sageretia Brandrethiana*, *Zizyphus nummularia* ; particularly characteristic are bushes of the dwarf palm *Nannorrhops Ritchieana*. (*212*) On slopes above 1000 m., there appear in addition *Quercus baloot*, *Fraxinus xanthoxyloïdes*, *Euonymus* sp., *Olea cuspidata*, *Rubus* sp., and occasionally the myrtle—*Myrtus communis*.

The plants enumerated of course form a number of different communities, but data regarding them in the literature are wanting.

The foregoing short inventory of plant communities (and their groups), the presence of which can be established with greater or less probability, and in other cases postulated, in the territory of Afghanistan, indicates that the plant covering of this country is distinguished by great variety, and there are clearly marked here a number of characteristic geobotanical provinces and regions.

This is well illustrated in our " Schematic map of the vegetation of Afghanistan "—as far as we know only the second geobotanical map of this country.*

On this map (fig. 2) there are naturally shown in the majority of cases only geographical complexes of plant communities, in view of the above-mentioned complete deficiency of accurate data on their distribution in Afghanistan—in other words, of the complete lack of geobotanical surveys.

The map has been compiled on a topographical basis, on a scale of 1 : 1,000,000, and use has been made of all available geobotanical maps of the adjoining districts of neighbouring countries ; this has also found expression on the map.

It seemed to us (and this was subsequently confirmed by L. E. Rodin [see p. 183, above]) that the basic principles of the distribution of the vegetation were expressed by this map with tolerable accuracy, and it has therefore been utilised, together with data on relief and climate, as the basic material for working out a scheme for the geobotanical regionisation of Afghanistan, to which the following chapter is devoted.

IV. Geobotanical Regionisation of Afghanistan

The object of geobotanical regionisation is the division of this or that territory into regions which are more or less homogeneous in their natural plant covering.

*The first geobotanical map of Afghanistan, incomparably more schematic than ours, was published in 1929 by Vavilov and Bukinich [3].

Geobotanical regionisation represents one of the methods of dismembering a territory into landscape regions, since the plant covering expresses in its composition and structure all the elements of the physico-geographical complex.

Geobotanical regionisation, apart from the theoretical scientific interest, has also a great practical importance, inasmuch as the current state of husbandry and the prospects of its further development are not uniform over the various landscape regions ; many details in the laying out and reconstruction of ancient centres of population are different, particularly in regard to their planting, the structural peculiarities of their buildings, and so on and so forth.

In working out a scheme of geobotanical regionisation for Afghanistan, we were unable (through lack of material) to base our work—as should have been the case—primarily upon data concerning the plant cover, but were obliged to make equal use of material on relief and climate.

(*213*) Thus the scheme of geobotanical regionisation of Afghanistan worked out by us is based principally on the general character of the physico-geographical conditions, in view of which the concrete boundaries of districts and regions must be considered as at present to some extent provisional—the more so as sufficiently trustworthy large-scale cartographic materials on Afghanistan are likewise not available.

Within the bounds of Afghanistan we distinguish provinces representing 4 geobotanical regions :

1. South Turkestan Ephemeral Province, beyond the limits of Afghanistan including also the regions of the south of Central Asia and northern Iran (Khorasan).

2. Central Asiatic Desert Province, beyond the limits of Afghanistan occupying vast desert tracts of Central Asia, separated from the oceans by high mountain elevations.

3. Afghano-Iranian Desert Province, including, besides the Afghan section, also the desert interior of Iran.

4. Indo-Himalayan Forest Province, apart from the small Afghan section, occupying likewise the southern (moist) slopes of the Himalayas and adjacent regions of Hindustan.

We give below a short characterization of the vegetation of these provinces within the limits of their Afghan portions, and also a list of the geobotanical regions ('circuits') composing them.

For the sake of brevity, the provinces are here characterized only by the general features of the vertical zonation of the vegetation ; the more detailed descriptions of provinces and geobotanical regions ['circuits'] which we have drawn up we propose to publish in another place.

1. South Turkestan Ephemeral Province

Occupies almost the whole of northern Afghanistan, comprising about 30 per cent. of the total area of Afghanistan.

Characterized by the wide distribution of meadow-like ephemeroid and ephemeral vegetation and the presence in the intermediate mountain

zones of tree-and-shrub, and in the highlands of steppe vegetation. The distribution of vegetation according to the altitude profile here is as follows :—

Up to 900 (1100) m. above sea-level—*zone of low-herbage ephemeroid vegetation*, in which are distinguished :

a) up to 500–600 m. —*zone of ephemeral–sedge–meadow-grass vegetation* ;

b) up to 900–1100 m.—*zone of coarse-herb–sedge–meadow-grass vegetation and pistachio communities.*

900 (1100)–1800 (2000) m.—*zone of medium-herb–ephemeroid vegetation, pistachio communities and scrub.*

1800 (2000)–2500 (in the west)–3000 (in the east) m.—*zone of tree-and-shrub vegetation*, represented by sparse juniper communities and scrub, and in the east (in western Badakhshan) also by maple and walnut woods.

2500 (3000)–4000 m.—*zone of high mountain vegetation*, in which are distinguished :

(*214*) a) from 2500 (3000) to 3500 m.—*subalpine zone*, with preponderance of drought-resistant vegetation on stony soils (steppes, tragacanth, *Cousinia* and *kamol* [*Ferula*] communities) ;

b) from 3500 to 4000 m.—*Alpine zone*, with preponderance of drought-resistant vegetation (steppes, tragacanth and *Cousinia* communities) and low-herbage meadows.

Above 4000 m. vegetation ceases.

To the South-Turkestan ephemeral province belong the following geobotanical regions : (1) Amu-darya lowland-, (2) Cis-Parapamiz low-mountain-, (6) West-Badakhshan high-mountain-, (7) East-Badakhshan high-mountain-.

2. Central Asiatic Desert Province

Occupies a small tract in extreme north-eastern Afghanistan, comprising less than 3 per cent. of its territory.

Characterized by the preponderance of desert semi-fruticose and steppe vegetation, uninterruptedly up to the highlands, and, as a considerable development in the alpine zone, of low-herbage *Cobresia* meadows.

2000–3700 m. above sea-level—*zone of desert semi-fruticose vegetation*, with preponderance of wormwood and *teresken* communities.

3700–5000 m.—*zone of high-mountain vegetation*, in which are distinguished :

a) from 3700 to 4000 m.—*subalpine zone*, with preponderance of high-mountain steppes ;

b) above 4000 m.—*alpine zone*, with preponderance of low-herbage-, chiefly *Cobresia* and *beskilnits* [*Atropis*], meadows.

To the Central Asiatic desert province belongs one geobotanical region : (8) Wakhan high-mountain-.

3. Afghano-Iranian Desert Province

Occupies the southern part of Afghanistan, comprising about 60 per cent. of the whole area of the country.

Characterized by the exceptional preponderance of desert semi-fruticulose and tragacanth-fruticulose vegetation, distributed over the altitudinal profile as follows :

Up to 3200 m. above sea-level—*zone of desert* (principally semi-fruticulose) *vegetation*, in which are distinguished :

a) up to 1000–1200 m.—*zone with predominance on earthy and rubbly soils of semifruticulose vegetation* (mostly pure wormwood and saltwort communities), occupying the plains and foothills of southern Afghanistan, with desert-semifruticose vegetation on sands, and with meadows and tree-and-shrub vegetation in the river-valleys where there is a high level of subsoil waters ;

(215) b) from 1000 (1200) to 2400 m.—*zone with preponderance of ephemeral–wormwood and feather-grass–wormwood desert communities*, principally on the rubbly slopes of medium- and low-altitude mountains ; here there occur also sparse pistachio-communities, and tragacanth shrublets (chiefly in the form of an admixture in wormwood communities) and possibly thickets of drought-resistant shrubs are common ;

c) from 2400 to 3200 m.—*zone with predominance of tragacanth–wormwood and feathergrass wormwood desert communities*, developed in the lower part of the high mountain tract.

3200–4400 m.—*zone of high-mountain* (principally herbaceous) *vegetation*, in which are distinguished :

a) from 3200 to 3800 m.—*subalpine zone*, with preponderance of fescue steppes and a considerable scattering of *Cousinia* and tragacanth communities (on stony slopes) ;

b) from 3800 to 4400 m.—*alpine zone*, with preponderance of low mixed-herbage-and-grass meadows, *Cousinia* communities and fescue steppes.

To the Afghano-Iranian desert province belong the following geobotanical regions : (9) Seistan-Registan lowland-, (10) West Afghan mountain-and-lowland-, (11) South Afghanistan low-mountain-, (12) Ab-i-Istadah mountain-and-lowland-, (13) Hazara high-mountain-, (14) Kabul mountain-.

4. Indo-Himalayan Forest Province

Occupies a small tract in south-eastern Afghanistan, comprising about 10 per cent. of the total area of the country.

Characterized by the preponderance in the natural plant covering of tree-and-shrub vegetation of Indo-Himalayan type, distributed over the altitudinal profile as follows :—

(750)–1200 (1500) m. above sea-level—*zone of subtropical steppes and deserts*, the basic vegetation of which is represented by grass communities, and also by thickets of subtropical shrubs, sometimes with a considerable proportion of low-growing palms (*Nannorhops*), and must evidently be referred to the savanna type in the broad sense.

1200–2400 (2700) m.—*zone of scrub communities and deciduous* (in the upper part coniferous–deciduous) *woodland*, the basic vegetation of which

is represented by oak-woods with a greater or less development of undergrowth, and also scrub ; in the upper part of the zone, and sometimes already beginning at 1700 m., there are added coniferous species, and the woodland becomes mixed.

(2400) 2700–3000 (3350) m.—*zone of coniferous woodland*, the basic vegetation of which is represented by coniferous woodlands with a small proportion of deciduous species.

(3000) 3350–4000 m. and upwards—*zone of high-mountain vegetation*, in which are distinguished :

(*216*) a) from (3000) 3350 to 3700 (4000) m.—*subalpine zone*, the basic vegetation of which is represented by scrub communities of procumbent junipers, willows and rhododendrons, of xerophil–mixed-herbage (*Cousinia*) communities, and probably of subalpine grass meadows ;

Fig. 1. Scheme of geobotanical regionisation of Afghanistan.
(I. A. Linchevsky and A. V. Prozorovsky, 1941).

South Turkestan ephemeral province.

1—Amu-Darya plain region ; 2—Cis-Parapamiz low-mountain region ; 3—Parapamiz mountain region ; 4—Bamian high-mountain region ; 5—Kattagan low-mountain region ; 6—Western Badakhshan high-mountain region ; 7—Eastern Badakhshan high-mountain region.

Central Asiatic desert province.

8—Wakhan high-mountain region.

Afghano-Iran desert province.

9—Seistan-Registan plain region ; 10—Western Afghan plateau region ; 11—Southern Afghan low-mountain region ; 12—Ab-i-Istada plateau region ; 13—Hazara high-mountain region ; 14—Kabul mountain region.

Indo-Himalayan forest province.

15—Nuristan high-mountain region ; 16—Dzhelalabad region ; 17—Sefid-kuh mountain region ; 18—Upper Gumal plateau region.

b) from (3700) 4000 m. and upwards—*alpine zone*, the basic vegetation of which is represented by alpine *Allium*–grass and *Cobresia* meadows, xerophil–mixed-herbage communities and the sparse vegetation of rocks and stony screes and wastes.

To the Indo-Himalayan forest province belong the following geobotanical regions : (15) Nuristan high-mountain-, (16) Dzhelalabad-, (17) Sefid-kuh mountain-, (18) Upper Gumal mountain-and-plain-.

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KEY TO SYMBOLS :

Desert vegetation.

1—solonchak-saltwort deserts on the solonchaks and solonchak soils of northern Afghanistan.

2—complex wormwood-saltwort deserts with a considerable proportion of solonchak-saltwort communities and black saxaul communities (in lacustrine regions), on the solonets serozyoms with patches of solonchaks and solonchak soils of western and south-western Afghanistan.

3—saltwort and wormwood-saltwort deserts on the rubbly and sandy-stony soils of the plains of southern Afghanistan.

4—sandy-shrubby (dzhuzgun-, white saxaul-) deserts on the hillocky sands of northern Afghanistan ; barkhans devoid of vegetation often occur.

5—sandy-shrubby deserts on the ridged sands of southern Afghanistan.

6—wormwood and tragacanth-wormwood deserts on the rubbly and gravelly soils of the low mountains and foothills of central and southern Afghanistan ; on soils rich in earth there are ephemeral-wormwood deserts.

7—wormwood-tragacanth deserts on the rubbly soils of the mountain slopes of central Afghanistan.

8—wormwood and teresken deserts of the dry high-mountain areas of north-eastern Afghanistan.

9—the same, with a considerable proportion of steppe grasses (feather-grass, fescue).

Herbaceous vegetation.

10—reed and other types of lake-meadows on the meadow-marsh soils of south-western Afghanistan.

11—sedge-meadowgrass ephemeroid vegetation with patches of saltwort deserts on the solonchak soils of the plains of northern Afghanistan.

12—sedge-meadowgrass vegetation on the loess serozyoms of northern Afghanistan.

13—sand-sedge ephemeroid vegetation with coarse perennials on the sandy soils of northern Afghanistan.

14—medium-herbage- (mixed-herbage–couchgrass, mixed-herbage) ephemeroid vegetation of the high foothills of northern Afghanistan, with patches of ephemeral (on the southern slopes) and desert-semi-fruticulose (on stony soils) vegetation.

15—subtropical steppes with shrubs and deserts on the plains and foothills of south-eastern Afghanistan.

16—sclerophyll–mixed-herbage and tragacanth vegetation with patches of meadows and steppes, among rocks and stony screes, in the high-mountain zone.

17—the same, with a considerable distribution of low-herbage Cobresia meadows.

18—meadow vegetation of the high mountains of eastern Afghanistan : in the subalpine zone scrub is characteristic ; in the alpine zone rocks and stony screes devoid of vegetation are common.

Tree and shrub vegetation.

19—*tugai* woods of olive, tamarisk and turanga, alternating with reed and other riverine meadows and saltwort stands (on solonchaks) in river valleys.

20—tamarisk thickets on the solonchak-like soils of the lake hollows of south-western Afghanistan.

21—pistachio (*Pistacia vera*) communities in the foothills of northern Afghanistan.

22—pistachio (*Pistacia cabulica*) communities in the foothills of southern Afghanistan.

23—evergreen oak-woods (*Quercus baloot*) and scrub on the mountain slopes of eastern Afghanistan (Nuristan and the Sefid-kuh).

24—juniper woods (*Juniperus seravschanica*) and scrub among rocks and stony screes on the mountain slopes of northern Afghanistan ; walnut (*Juglans regia*), ash and other deciduous woods and scrub on the mountain slopes of north-eastern Afghanistan (western Badakhshan).

25—juniper woods (*Juniperus excelsa* s.l.) and scrub among rocks and stony screes on the mountain slopes of eastern Afghanistan.

26—pine, cedar, fir and spruce forests on the mountain slopes of eastern Afghanistan (Nuristan and Sefid-kuh).

Supplementary symbols.

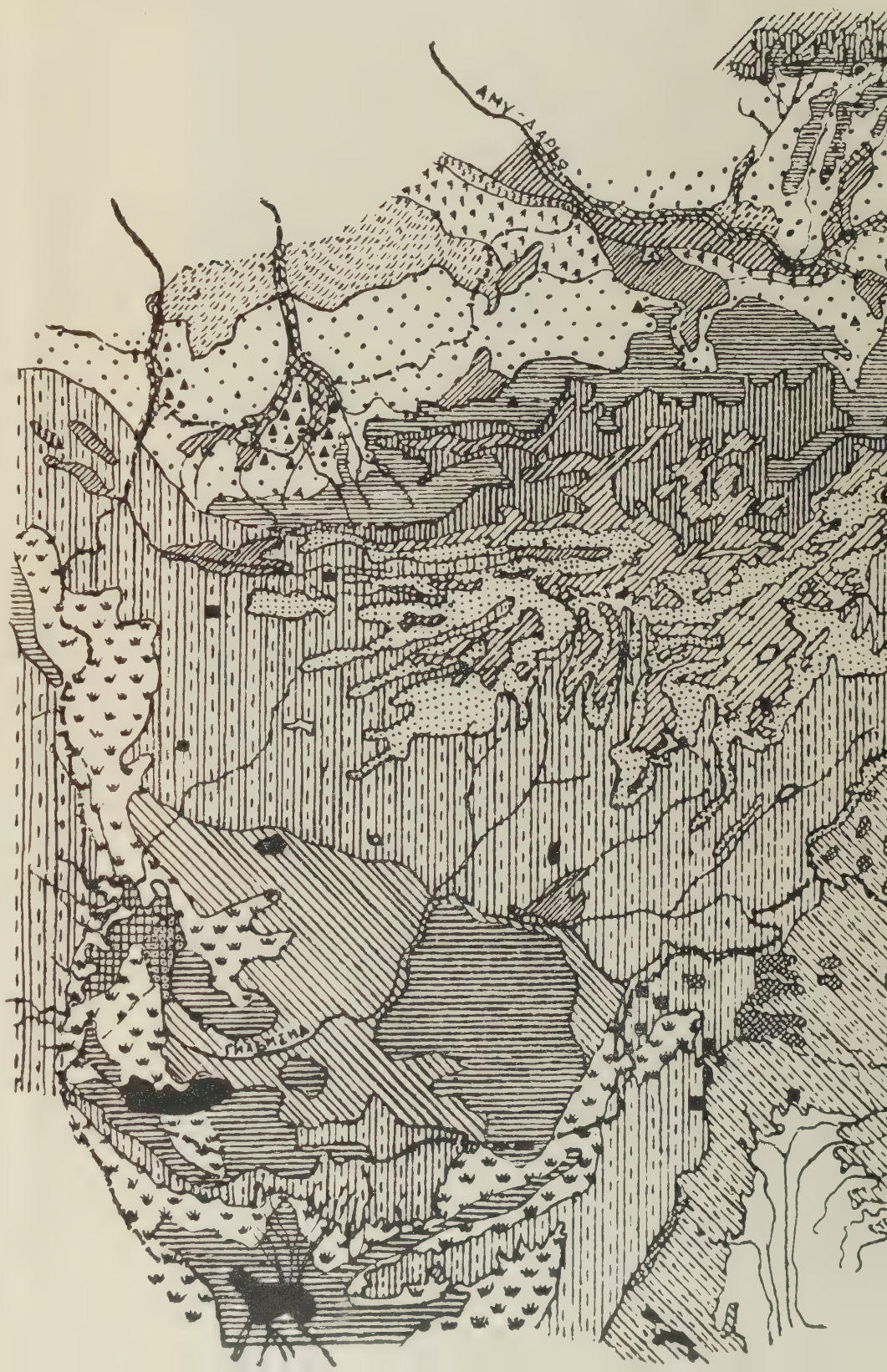
27—large oases.

28—solonchaks devoid of vegetation.

29—high-mountain regions devoid of vegetation (rocks, perpetual snows and glaciers).

30—lakes.

FIG. 2. Schematic map of the vegetation of Afghanistan (with adjacent portions of the USSR, Iran and India). Prepared by I. A. Linchevsky and A. V. Prozorovsky (1941).



NEW NAMES IN CAMELLIA.

J. Robert Sealy.

During work on a revision of *Camellia* a number of specimens in the Kew and Edinburgh Herbaria were noted as new species. The preparation of the revision for publication must inevitably take some time, and it is therefore thought advisable to publish the new species in advance. In addition to those represented at Kew and Edinburgh, two others are included based on material in the Arnold Arboretum Herbarium. These had been noted as probably new by Dr. Merrill, and were very kindly sent by him with the suggestion that I should publish them if necessary. The opportunity is also taken to distinguish two new varieties, and to make a few new combinations that are required. I would like to take this opportunity of recording my very grateful thanks to Sir William Wright Smith, who most kindly sent on loan all the *Camellia* material from the Edinburgh Herbarium, and to Dr. Merrill, who, in addition to sending the specimens of the new species, also sent on loan material of certain species not available in this country.

Camellia assimiloides Sealy, sp. nov. *C. fraternae* Hance et *C. cuspidatae* Kochs Cohen Stuart affinis, ab ambabus sepalis bracteolisque majoribus staminibus valde coalitis ovario dense tomentoso, ab illa foliis angustioribus caudatis, ab hac bracteolis puberulis sepalis velutinis petalis dorso velutinis differt ; *C. assimile* Champ. simulans sed androecio styloque glabro longiore, corollis majoribus, bracteolis 4 (nec 5–7) distans.

Frutex ramis ramulisque gracillimis virgatis, junioribus minute puberulis vel holosericeis, demum cortice exfoliato glabris. *Folia* breviter petiolata ; *laminae* ellipticae vel oblongo-ellipticae longe obtuse caudatae, basi cuneatae vel late cuneatae, (3)–5–7 cm. longae, (1)–1·5–2 cm. latae, obtuse et distante serrulatae dentibus a 2·5 3 mm. separatis et minute nigro-apiculatis, tenuiter coriaceae, supra splendide virides, subtus paullo pallidiores, glabrae ; *petioli* 2 3 mm. longi, dense puberuli. *Flores* solitarii vel geminati, terminales vel axillares, breviter pedicellati. *Pedicellus cum calyce* 1 cm. longus; pedicellus bracteolis 4 subsemiorbicularibus puberulis ciliatis valde appressis vestitus. *Calyx* alte cupularis; sepala 5, semiorbicularia, circiter 4 mm. alta et 5 mm. lata, minute fusco-mucronata, intus dorsoque velutina, crassa. *Corolla* circiter 2 cm. longa, alba ; petala 8, a basi usque ad 1 cm. ad androecium adnata, late ovalia vel late obovata vel suborbicularia, 1·6–2 cm. longa, 1·1–1·7 cm. lata, vel intima 1·2 cm. longa et 6 mm. lata, exteriora satis carnosa marginibus ad basin exceptis dorso et intus tomentosa vel velutina, interiora magis petalina et minus pilosa, intima glabra. *Androecium* 1·8 1·9 cm. longum, filamentis exterioribus a basi in tubum carnosum 1·2 1·3 cm. longum coalitis, glabrum. *Gynoecium* 1·9 cm. longum ; ovarium dense albo-tomentosum, in stylum crassum circiter 1·6 cm. longum basi excepto glabrum ad apicem 3-fidum ramulis 1 mm. longis productum.

China: Kwangtung, Pan Ling Tze, *W. Y. Chun* 5906 (typus in herb. Edinensi).

Camellia crassipes Sealy, sp. nov. apud congeneros pedicello breviter cylindraceo bracteolis 2 juxta calycem instructo insignis ; ex affinitate *C. forrestii* (Diels) Cohen Stuart et *C. polygamae* (Hu) Hu, sed foliis multo majoribus caudatis, floribus majoribus valde discrepat.

Arbor parva (*fide* Maire), ramulis breviter hirsutis demum atrocinereis. *Folia* breviter petiolata ; laminae ellipticae, caudatae, ad basin cuneatae, 3·5–6·5 cm. longae, 1·5–2·2 cm. latae, perbreviter serrulatae, coriaceae, supra saturate virides costa minute hirtella excepta glabrae, subtus lucide virides costa villosa ; petioli 2–3 mm. longi, breviter hirsuti. *Flores* breviter pedicellati, solitarii vel geminati, in ramulis hornotinis terminales et axillares ; pedicelli breviter cylindracei, 4 mm. longi, bracteolis 2 late ovatis margine membranaceis ciliolatis juxta calycem instructi. *Calyx* alte cupularis ; sepala 5, inaequalia, latissime ovata vel suborbicularia, rotundata, 3–5 mm. longa, 6–5 mm. lata, crustacea, dorso ± sparse pilosa, intus velutina, ciliolata. *Corolla* alba, circiter 2 cm. longa, petalis 6 inter se et ad stamina basi per 3 mm. conjunctis ; petala 2 exteriora suborbicularia, circiter 10–12 mm. diametro, coriacea, valde concava, dorso pilosa ; petala interiora 4, latissime obovata vel suborbicularia, intima obovata, leviter retusa vel emarginata vel truncata vel rotundata, 1·2–1·7 cm. longa, 2–1·2 cm. lata, dorso pilosa. *Androecium* luteum, circiter 1·6–1·8 cm. longum, filamentis exterioribus ad corollam per 2–3 mm. basi affixis, glabrum. *Gynoecium* 1·5–1·7 cm. longum, glabrum ; ovarium oblongo-ovoideum ; stylus 1·3–1·5 cm. longus, in ramulos 3–4 6–9 mm. longos stigmato-capitatos divisus.

China : Yunnan, Long-ky, *E. E. Maire* 610/1914 (typus in herb. Edinensi).

Camellia cuspidata (Kochs) Cohen Stuart var. **grandiflora** Sealy var. nov. in characteribus ramorum foliorumque typo omnino consimilis sed floribus duplo majoribus valde discrepat.

Thea cuspidata Kochs : Handel-Mazzetti, Symb. Sinicae, **7,** 394 (1931).

Flores breviter pedicellati, terminales, solitarii. *Pedicellus cum calyce* circiter 12 mm. longus; pedicellus versus apicem incrassatus, glaber, bracteolis 4 late triangularibus et obtusis vel late ovatis rotundatis et mucronatis 1·5–2·5 mm. longis concavis ciliolatis glabris vel intus ad apicem parce pilosis persistentibus distantibus vel paullo imbricatis ornatus ; sepala 5, imbricata, late ovata vel suborbicularia, rotundata et minute mucronata, 3–5·5 mm. longa, 4–5·5 mm. lata, crustacea, anguste membranaceo-marginata, dorso glabra, intus ± dense sericeo-pubescentia, persistentia. *Corolla* 3·5–4 cm. longa, alba, e petalis circiter 7 ad androecium a basi usque ad 7–8 mm. adnatis composita ; petala exteriora 2–3 orbicularia vel oblata vel late ovalia, 1–1·5 cm. longa, 0·9–2·1 cm. lata, nonnihil coriacea, supra ad apicem velutina ; petala interiora parte libera late obovata vel orbiculare vel late ovata truncata vel rotundata vel emarginata 2·2–3·3 cm. longa et 2·2–2·9 cm. lata. *Androecium* circiter 2·3–2·7 cm. longum, filamentis exterioribus a basi usque ad 6–8 mm. coalitis. *Gynoecium* circiter 2·1 cm. longum, glabrum ; ovarium ovoideum ; stylus fere 2 cm. longus, trifidus, ramis circiter 2 mm. longis.

China : Hunan, Yün-schan prope Wukang, *Wang Te Hui* (*Handel-Mazzatti* no. 11155)—typus in herb. Edinensi.

Camellia euphlebia Merrill (MS.) ex Sealy, sp. nov. ex affinitate *C. amplexicaulis* (Pitard) Cohen Stuart et *C. petalotii* (Merrill) Sealy, ab ambabus foliis minoribus ad basin obtusis vel subrotundatis, pedicellis multo brevioribus bracteolis valde imbricatis distincta.

Frutex 2 m. vel ultra altus, ramulis crassis obscure purpureo-brunneis glabris, ramis cinereis. *Folia* petiolata ; laminae ovales, breviter late obtuse cuspidato-acuminatae, basi obtusae vel sub-rotundatae, 11–14 cm. longae, 4·5)-5 6·4 cm. latae, obtuse serrulatae dentibus a 3–4 mm. separatis, tenuiter coriaceae, glabrae, supra saturate virides, subtus pallide virides, venis reticuloque supra impressis subtus prominente elevatis ; petioli 10 13 mm. longi, crassi, lutescentes, glabri. *Flores* suaveolentes, pedicellati, solitarii et terminales. *Pedicellus* circiter 5 mm. longus, bracteolis circiter 8 imbricatis patentibus instructus ; bracteolae semiorbiculares, leviter emarginatae, 1–3 mm. longae, crustaceo-squamiformes anguste tenuimarginatae, leviter concavae, glabrae, ciliolatae, brunneae, supremae sepalis similes. *Sepala* 5, semiorbicularia, inaequalia, 3–5 mm. longa, coriaceo-squamiformia, tenuiter marginata, concava, dorso glabra et brunnea, intus griseo-velutina. *Corolla* circiter 4 cm. longa, sulphurea, e petalis 8–9 composita ; petala exteriora 2 fere libera, suborbicularia, 1·2-1·4 cm. longa, coriaceo-squamiformia, concava, dorso brunnea et glabra, intus griseo-velutina ; petala cetera basi usque ad 10 mm. ad tubum staminum coalita, parte libera sub-orbiculari vel late obovata vel ovali 2·2-3 cm. longa et 2·2–2·5 cm. lata, exteriora ad apicem coriacea facie velutina, intima petalina. *Androecium* circiter 3·6 cm. longum, filamentis exterioribus a basi per 1·6–1·7 cm. in tubum latum carnosum coalitis, filamentorum parte libera filiformi ; antherae anguste oblongae, 2-3 mm. longae. *Gynoecium* 4 cm. longum, glabrum ; ovarium ovoideum, 3 mm. altum ; styli 3, 3·7 cm. longi, omnino liberi.

Indo-China : Tonkin, Kau Nga Shan and vicinity, Tien-yen, *W. T. Tsang* 27346 (typus in herb. Arn. Arb.).

Recognised as a probable new species by Dr. E. D. Merrill, who suggested the name.

Camellia flava (Pitard) Sealy, comb. nov.

Thea flava Pitard in Lecomte, Fl. Gén. Indo-chine, **1,** 346 (1910); Gagnepain in Suppl. ibid. **1,** 304, 319 (1943).

Camellia cordatula Merrill in Journ. Arn. Arb. **20,** 348 (1939).

Camellia fleuryi (A. Chev.) Sealy, comb. nov.

Thea fleuryi A. Chevalier in Bull. Écon. Indo-chine, **21,** 531 (1919) ; Gagnepain in Suppl. Fl. Gén. Indo-chine, **1,** 303, 306 (1943).

Camellia gaudichaudii (Gagnep.) Sealy, comb. nov.

Thea gaudichaudii Gagnepain in Not. Syst. **10,** 127 (1942), et in Suppl. Fl. Gén. Indo-Chine, **1,** 304, 319 (1943).

Thea hongkongensis (Seem.) Pierre, Fl. For. Cochinch. t. 117 (1887) et Pitard in Lecomte, Fl. Gén. Indo-chine, **1,** 344 (1910), quoad *Gaudichaud* 271.

Camellia hongkongensis Seeman in Trans. Linn. Soc. London, **22,** 342 (1859) quoad *Gaudichaud* 271.

A *C. hongkongensi* Seem. qua ab initio confusa erat, foliis minoribus ellipticis obtuse acutis vel obtusis, gynoecio perbreviore stylis 7–9 mm. longis (nec 3–3·3 cm. longis) dense pilosis valde differt ; apud species

stylis liberis *C. crapnellianae* affinis, sed foliis minoribus, stylis brevioribus recedit. *Fructus* subglobosus, circiter 3 cm. diametro, cinereus, furfuraceus, 3-locularis, in valvas tres crasso-coriaceas loculicide dehiscens, in medio columnella crassa erecta. *Semina* plano-convexa vel cuneato-convexa, 1·5–1·6 cm. longa et lata, saturate brunnea, laevia.

HAINAN : Tung Koo Shan et vicinitate, prope Shan Hoi, Wen-ch'ang distr., *H. Fung* 20336.

INDO-CHINA : Annam, Tourane, *Gaudichaud* 271 (herb. Paris.—typus).

Camellia gracilipes Merrill (MS.) ex Sealy, sp. nov. inter congeneros pedicellis longissimis circiter 3 cm. longis pergracilibus bracteolis 2 suboppositis minutis ornatis, fructibus subglobosis apice obtuse conicis a basi loculicide dehiscentibus insignis.

Frutex 2–3 m. (vel ultra) altus, ramis ramulisque gracilibus ; ramuli juniores gracillisimi pubescentes purpurei, vetustiores cortice exfoliato cinerei. *Folia* breviter petiolata ; laminae lanceolato-ellipticae vel anguste oblongo-ellipticae in apicem longe acuminatum vel caudatum sensim prolongatae, basi obtusae vel rotundatae, plerumque 6–10 cm. longae et 1·2–2·2–(2·6) cm. latae, late serrulatae dentibus obtusis a 4–6 mm. separatis, firme papyraceae, supra saturate virides glabrae et venis conspicuis, subtus pallidiores in costa pubescentes et costa nervisque elevatis ; petioli 2–4 mm. longi, pubescentes. *Flores* longe pedicellati, suaves, terminales et axillares, solitarii vel geminati. *Pedicelli* pergraciles, circiter 3 cm. longi, primum sparsissime pubescentes cito glabri, supra medium bracteolis 2 oblongis apiculatis 0·5–1·5 mm. longis membranaceis subpersistentibus ornati. *Sepala* 5, inaequalia, patentia, transverse semi-ovalia vel semi-orbicularia, 1–2 mm. longa, 2–4 mm. lata, coriacea tenuiter marginata, glabra, ciliolata, persistentia. *Corolla* alba vel flavescens (?) ; petala circiter 7, basi ad androecium adnata, suborbicularia vel subquadrata in alabastro evoluto 6–8 mm. longa et lata (demum ad 10 cm. longa vel ultra ?), valde concava, medio coriacea et dorso dense sericeo-cano-tomentosa, marginibus tenuioribus et glabris, facie glabra. *Androecium* in alabastro evoluto 6 mm. longum (demum saltem 10 cm. ?), filamentis exterioribus basi per 1–2 mm. coalitis, glabrum. *Gynoecium* in alabastro evoluto 6 mm. longum (demum saltem 10 mm. longum ?), ovarium dense fulvo-tomentosum ; styli 3, ad tertiam partem coaliti, ad medium tomentosi. *Fructus* subglobosus in apicem breviter obtusum conicum leviter 3-canaliculatum productus, 2·3–2·5 cm. longus, 2–2·5 cm. diametro, fusco-brunneus, vestigio tomenti indutus, unilocularis (interdum 2-vel 3-locularis ?), semina 1–3 gerens, a basi loculicide dehiscens valvis tenuiter coriaceis. *Semina* globosa vel semiglobosa vel cuneato-concava, 1·5–1·9 cm. longa, 9–16·5 mm. lata, laevia, splendide castanea vel saturate brunnea.

INDO-CHINA : Tonkin Taai Wong Mo Shan et vicinitate, Ha-coi [Hakoi], Chuk-phai, *W. T. Tsang* 27106, 27151, 27275 (typus in herb. Arn. Arb.) ; Tong Fa Market, *W. T. Tsang* 29576.

These four specimens were kindly sent on loan from the Arnold Arboretum herbarium by Dr. E. D. Merrill, who had recognised them as constituting a new species and had suggested for them the name *Camellia gracilipes*.

Camellia handelii Sealy, sp. nov. affinis *C. fraternae* Hance floribus foliisque minoribus valde discrepat.

Frutex ramosissimus, ramulis gracillimis dense pubescentibus, ramis vetustioribus gracilibus cortice exfoliati glabrescentibus cinereis. *Folia* breviter petiolata ; laminae ovatae vel ovato-ellipticae in apicem obtusum sensim attenuatae, basi cuneatae vel late cuneatae, (1·6)–2–3–(3·6) cm. longae, 1·1–1·5 cm. latae, serrulatae dentibus apiculis nigris instructis, supra valde virides in costa breviter hirsutae, subtus subglaucae in costa basi sparse pilosae ; petioli 1–2 mm. longi, dense pubescentes. *Flores* terminales, sauves (fide Handel-Mazzetti), pedicellati. *Pedicellus* cum *calyce* 5–6·5 cm. longus ; *pedicellus* bracteolis 5 1 1·5 mm. longis dense sericeo-villosis persistentibus obtectus; *sepala* 5, rotundata, circiter 2–2·5 mm. longa, dense sericeo-villosa, persistentia. *Corolla* 1·7–2 cm. diametro, alba, e petalis 5–6 basi usque 4 mm. ad tubum staminum adnatis composita ; petala 2 externa suborbicularia, 7–9 mm. longa, 6–11 mm. lata, subcoriacea, concava, dorso ad apicem pilosa ; petala 3–4 interna late ovata vel late ovalia vel suborbicularia, rotundata vel emarginata, parte libera 1·4–1·7 cm. longa et 1·3–1·6 cm. lata, glabra vel dorso ad apicem sparse pilosa. *Androecium* 1·1–1·3 cm. longum, album (?), filamentis exterioribus a basi per unam tertiam partem usque ad duas tertias partes in tubum coalitis; antherae flavae (?). *Gynoecium* circiter 1·3 cm. longum, glabrum ; stylus circiter 1·2 cm. longus, trifidus, ramis 3 mm. longis.

HUNAN : Yolu-shan, prope urbem Tschangscha, in silva sclerophylla, alt. 70–300 m., *Handel-Mazzetti* 11503 (typus in herb. Kew.).

Camellia krempfii (Gagnep.) Sealy, comb. nov.

Thea krempfii Gagnepain in Not. Syst. **10,** 127 (1942) et in Suppl. Fl. Gén. Indo-chine, **1,** 304, 319 (1943).

Camellia petalotii (Merr.) Sealy, comb. nov.

Thea petalotii Merrill in Univ. Calif. Publ. Bot. **10,** 427 (1924).

C. pitardii Cohen Stuart var. **yunnanica** Sealy, var. nov. foliis ellipticis vel oblongo-ellipticis basi cuneatis et in apicem acutum vel acuminatum sensim attenuatis rarius abrupte acutis vel obtusis (haud abrupte acuminatis nec caudatis) breviter serrulatis (nec valde serrulatis nec serratis), stylis brevioribus 1·7–2·2 cm. longis insignis.

SZECHUAN: Lungdschu-schan prope urbem Huili, *Handel-Mazzetti* 886 (herb. Edin.) ; Huili, *Schneider* 568.

YUNNAN : Tien sin, Kiao Kia region, *S. Ten* (Ducloux 1046, herb. Edin.) ; " Ouei chir (Yunpe)" *S. Ten* 38 (herb. Edin.) ; Yungpeh Mts. 26° 45′ N., *Forrest* 11093; Chienchuan-Mekong divide, 26° 40′ N., 99° 40′ E., *Forrest* 22574 (?) ; Sungkwe pass, *Rock* 25175 (herb. Edin.) ; Mts. near Sungguch [Sungkwe ?] towards Tengchuan, *Schneider* 2730 ; Ghi-shan, 25° 55′ N., *Forrest* 15511 (?), Yunnan-fu to Tsu-hsiong-fu [Chu-hsuing fu], *Forrest* 423 ; vicinity of Yunnan fu, *Maire* 390 (herb. Edin.), 553, 1079 (herb. Edin.), 1082 (herb. Edin.), 1456 (herb. Edin.) ; ibid. *Bodinier* 127 (herb. Edin.) ; " I-mên district " (? Yimen c. 70–80 Km. SW. of Yunnan fu) *Ducloux* (*A. Henry* 10589A—typus); Chu-yuan,

A. Henry 10589 ; Mengtze, *Hancock* 262 ; mts. N. of Mengtze, *A. Henry* 9099, 9109.

C. pitardii Cohen Stuart, as originally described, has caudate or abruptly acuminate very prominently serrulate or almost serrate leaves. It comes from Kweichow, and has also been found near Mengtze, south-east Yunnan, and in western Szechuan and adjacent Sikang. Widely distributed at moderate elevations throughout Yunnan, and in the adjacent part of southern Szechuan, are plants which greatly resemble the original *C. pitardii* in most characters but which are readily distinguishable by the leaf blades being relatively narrower and generally more attenuated both to the base and apex and much less prominently serrulate. There is considerable variation in size of flowers while the floral perules vary from glabrous with a ciliate margin to very densely silky-tomentose. There is also variation in size of leaves and though on some twigs the leaves approach those of *C. saluenensis* in size, they are generally much larger and agree in this respect with those of *C. pitardii*. Though there seems no doubt that the plants which are here included in var. *yunnanica* do grow wild in Yunnan (see Handel-Mazzetti, Naturbilder aus Südwest China, 9, 14, 24, 123 : 1927, sub *Thea speciosa*), Bodinier recorded his no. 127 as " Environs de Yun-nan sen. Camellia à fleurs roses qui se vend en ville en grandes quantités aux environs du Kó guien. Venu de la montagne" and Hu wrote (Journ. Roy. Hort. Soc. London , **63,** 387: 1938) " . . . Yunnan is famous for the numerous varieties of beautiful Camellias. Over seventy varieties all of great beauty are cultivated in Yunnanfu, the capital of the province. When in season their splendour is not rivalled by any other flower . . ." The majority of these cultivated *Camellia* " varieties " probably belong to *C. pitardii* var. *yunnanica* and to *C. saluenensis*—which has also been recorded from the neighbourhood of Yunnan fu—but it is possible that *C. pitardii* sensu stricto, *C. reticulata*, and *C. japonica* variants may also provide a quota of the " varieties " grown. There is a distinct resemblance between some of the plants referred to var. *yunnanica* and some of the *saluenensis-japonica* hybrids raised in this country but so far as I can see none of specimens from Yunnan really are hybrids with *C. japonica*.

Camellia stuartiana Sealy, sp. nov. ex affinitate *C. fraternae* Hance sed ramulis dense puberulis, foliis majoribus, floribus minoribus, gynoecio 4-vel 5-carpellato, stylo ad apicem per 7–9 mm. in ramulis 4 vel 5 diviso distincta.

Arbor circiter 6 m. alta (fide A. Henry), ramulis gracilibus rectis dense appresse puberulis, ramis purpureo-griseis. *Folia* petiolata ; laminae late ellipticae vel oblongo-ellipticae, breviter late obtuseque acuminatae usque caudatae, basi cuneatae vel late cuneatae, 7·2–10·5 cm. longae, 3–4 cm. latae, serrulatae dentibus a 1·5–2 mm. separatis, tenuiter coriaceae, supra saturate virides costa hirtella, subtus pallide virides et sparse appresse villosae ; petioli 5–7 mm. longi, dense appresse puberuli. *Flores* breviter pedicellati, solitarii vel geminati, in ramulis hornotinis terminales vel axillares. *Pedicellus* cum *calyce* circiter 7 mm. longus, dense cinereo-villosus; pedicellus circiter 3 mm. longus, crassus, bracteolis 5 vix imbricatis appressis late triangularibus acutis 1–1·5 mm. longis coriaceis dense villosis ornatus. *Calyx* alte cupularis, 3–4 mm. longa, 5–6 mm. lata ; sepala inaequalia, latissime ovata et acuta vel semi-

orbicularia, 2-3 mm. longa, dorso dense villosa, intus glabra. *Corolla* circiter 1·7 cm. longa et 2 cm. diametro, alba, e petalis 5–7 basi ad tubum staminum per 4 mm. conjunctis composita ; petala 2 exteriora fere libera, suborbicularia, concava, coriacea, dorso dense villosa ; petala 3–5 interiora suborbicularia vel late obovata vel ovalia vel oblongo-ovata, retusa vel rotundata, parte libera 12-13 mm. longa et 12–9 mm. late, ± petalina, dorso ad apicem villosa. *Androecium* circiter 1·4–1·5 cm. longum, glabrum, filamentis exterioribus per 6-7 mm. supra basin in tubum carnosum coalitis. *Gynoecium* 1·8-1·9 cm. longum, glabrum ; ovarium circiter 1·5 mm. altum et 2·5 3 mm. latum, leviter 5-lobatum, in stylo attenuatum ; stylus 1·7–1·8 cm. longus, in ramulos 4 vel 5, 7–9 mm. longos capitatos profunde divisus.

China : Yunnan, Yuankiang (" Yuanchiang "), *A. Henry* 13278 (typus in herb. Kew.).

Camellia synaptica Sealy, sp. nov. affinis *C. euryoidi* Lindl. et *C. tsofui* Chien, ab ambabus ramulis puberulis mox glabris foliis ellipticis vel late ellipticis caudatis majoribus, ab illa pedicellis brevioribus androecio longiore, ab hac corolla paulo majore androecio glabro differt ; quoad folia *C. cuspidatae* Kochs) Cohen Stuart et *C. tsaii* Hu similis sed ab ambabus pedicellis longioribus calycibus minoribus haud crustaceis discrepat.

Frutex circiter 3 m. altus vel arbor parva ; ramuli recti graciles subtiliter puberuli mox glabri, ut rami vetustiores sordide purpureo-cinerei. *Folia* petiolata ; laminae ellipticae vel late ellipticae, basi anguste cuneatae vel cuneatae, apice caudatae (cauda 1·5–2 cm. longa) vel in foliis minoribus acuminatae, plerumque 4·5-9 cm. longae et 1·8–3·4 cm. latae, serrulatae dentibus leviter incurvatis plerumque a 1·5-2 mm. separatis, tenuiter coriaceae, supra valde virides costa hirtella excepta glabrae, subtus pallide virides et glabrae vel in costa subtiliter adpresse pilosae cum epidermi verruculosa ; petioli 3-4 mm. longi, puberuli. *Flores* pedicellati, terminales et axillares, solitarii vel geminati. *Pedicellus* cum *calyce* (6)-7 9 mm. longus; pedicellus (4) 5–7 mm. longus, glaber, bracteolis 4 vel 5 late triangularibus vel semi-orbicularibus vix 0·5 mm. ad 1·75 mm. longis ciliatis interdum in dorso pubescentibus inter se separatis ornatus. *Sepala* 5, late et breviter rotundata, 1–1·5 mm. alta, circiter 2 mm. lata, ciliata, in dorso glabra vel parce pubescentia, facie velutina. *Corolla* alba, circiter 2–2·3 cm. longa, e petalis 5-6 basi ad tubum staminum usque ad 5 mm. conjunctis composita; petala exteriora 1 vel 2, suborbicularia, 8-10 mm. diametro, coriacea, concava, ciliolata ; petala interiora 3 vel 4 parte libera obovata vel suborbiculari emarginata 12–18 mm. longa et 11–13 mm. lata. *Androecium* circiter 17 mm. longum, filamentis exterioribus a basi in tubum crassum 8 mm. longum coalitis. *Gynoecium* 1·5-2 cm. longum, glabrum ; ovarium circiter 1·5 mm. longum ; stylus 13·5–18·5 mm. longus, ad apicem trifurcatus ramis 1 mm. longis luteo-capitatis.

China : Yunnan, " Long-Ki ", *E. E. Maire* (609/1914 in herb. Edin.—typus) ; ibidem ? " Long-ty " in vicinitate Pe-yen-tsin, *Siméon Ten* 493.

Camellia tenii Sealy, sp. nov. a *C. punctata* (Kochs) Cohen Stuart foliis perulisque plerumque minoribus, filamentis staminum exteriorum minus alte coalitis, stylis 3 omnino liberis multo brevioribus differt ; affinis *C. forrestii* (Diels) Cohen Stuart et *C. polygamae* (Hu) Hu sed ab

ambabus bracteolis et sepalis unam seriem perularum formantibus, ovario dense tomentoso, stylis 3 omnino liberis valde discrepat.

Frutex erectus, 1 m. altus (*fide* Ten), ramulis hornotinis rubescentibus pubescentibus pilis crispis patentibus per annos 2–3 persistentibus, ramulis vetustioribus sordide cinereis, ramis pallide cinereis. *Folia* breviter petiolata ; laminae ellipticae, obtusae vel obtuse acutae, late cuneatae, plerumque 2·5–4·3 cm. longae et 1·2–2·2 cm. latae, late et brevissime serrulatae dentibus nigro-terminatis a 1·5–3 mm. separatis, tenuiter coriaceae, supra valde virides costa hirtella excepta glabrae, subtus laete virides glabrae vel in costa ad basin sparse villosae, utrinque costa et venis in sicco manifestis et lutescentibus ; *petioli* 3–5 mm. longi, luteo-brunnei, dense pubescentes pilis aliis crispis aliis rectis. *Flores* sessiles, terminales et axillares, solitarii vel geminati. *Perulae* (bracteolae et sepala unam seriem formantia) 9–10, intima suborbicularis 4·5–5 mm. diametro, aliae imbricatae in cupulam 3·5–4 mm. altam dispositae, persistentes, semi-orbiculares, 1–2 mm. longae, concavae, coriaceae, membranaceo-marginatae, dorso ± griseo-puberulae, intus glabrae. *Corolla* alba, 11–14 mm. longa, e petalis 6 basi per 1·5–3 mm. ad androecium adnatis composita ; petalum extimum 5–6 mm. diametro, valde concavum, nonnihil coriaceum ; petala cetera obovata vel anguste obovata vel oblonga (intima), rotundata vel emarginata, 8–12 mm. longa, 5–8 mm. lata. *Androecium* circiter 9 mm. longum, filamentis staminum exteriorum basi usque ad 3 mm. coalitis, glabrum. *Gynoecium* circiter 8 mm. longum ; ovarium dense albo-tomentosum, 2 mm. altum ; styli 3, omnino liberi, circiter 6 mm. longi, glabri.

China : Yunnan, near Paiyentsing (Pe yen tsin) *Siméon Ten* 20 (typus in herb. Edin.).

A NEW SPECIES OF CAPILLIPEDIUM FROM INDIA.

N. L. Bor.

Capillipedium planipedicellatum *Bor*, sp. nov., ab omnibus speciebus hujus generis adhuc descriptis pedicellis spicularum pedicellatarum oblanceolatis planis conspicue recedit,

Gramen perenne in humidis vel paludibus incolens. *Culmi* usque 120 cm. alti, graciles, laeves glabrique, purpurei, erecti, nodis glabri. *Foliorum laminae* usque 8 cm. longae, 3 mm. latae, lineares, plicatae nonnumquam planae, in apicem acuminatum longe attenuatae, utrinque marginibusque scabrae, basi rotundatae, fauci longe pilosae ; *foliorum vaginae* internodiis breviores, culmum complectentes, striatulatae, laeves glabraeque ; *ligula* brevis, membranacea, margine superiore ciliata.

Panicula ad 20 cm. longa, 7–8 cm. lata, ramis verticillatis patentibus, basi nudis et apicibus racemos spicularum breves gerentibus, 6–7 cm. longis, capillaribus, flexuosis, ramosis, nodis binatis, laevibus glabrisque. *Racemi* fragiles, e tribus spiculis sessilibus plerumque compositi ; duo infimae cum singula spicula pedicellata, terminalis cum duabus spiculis pedicellatis comitatae ; racemorum internodia et pedicelli laeves glabrique, similes, 1·5–2·25 mm. longi, explanati ; pars media hyalina ; pedicelli oblanceolati apice leviter incrassati, purpurei, fragiles ; spicula sessilis cum internodio racemi contiguo pedicelloque decidua ; spicula

pedicellata ab pedicello decidua. *Spicula sessilis* 3 mm. longa, elliptico-oblongo-acuta, e dorso compressa. *Gluma inferior* 3 mm. longa, callo breve latoque, 9-nervis, elliptico-oblongo-acuta, chartacea, laevis, glabra, purpureo suffusa, sub-bicarinata, marginibus anguste inflexis ; *gluma superior* aequilonga dorso valde carinata, lanceolata acuta, 3-nervis marginibus anguste inflexis, purpurea, laevis, glabra. *Anthoecium inferum* nullum. *Anthoecium superum* hermaphroditum ; *lemma* nulla vel squama angustissima hyalina ; *palea* late triangularis, hyalina, 1·5 mm. longa, 1 mm. lata ; *lodiculae* duae, truncato-cuneatae ; *styli* duo ; *stigmata* duo plumosa ; *stamina* tria ; *antherae* non visae. *Spicula pedicellata* ; internodiis pedicelli similes sed apice latiores ; *spiculae* multo deminuatae tandum ad duas glumas vestigiales redactae ; *gluma inferior* 1·5 mm. longa, anguste vel late lanceolata, acuta ; *gluma superior* multo brevior ; *anthoecia* nulla.

India. Manipur State, Palel, 800 m., 10 Oct. 42, *N. L. Bor*, 17059. (Typus in Herb. Kew. et in Herb. Dehra Dun). " A grass 3′ -4′ tall—in swamps—spikelets purple."

Manipur State, where this remarkable grass is found, occupies a basin in the hills between Assam and Burma. The Manipur Valley, approximately 700 m. above sea level, was obviously at one time a shallow lake which is in progress of being filled up with detritus from the surrounding hills. The watertable is everywhere very high and practically at soil surface during the rainy season, so that the area abounds in swamps from which the water slowly disappears during the dry season. It is in these swamps that *Capillipedium planipedicellatum* is at home and it is so common that large stretches of swamp at the foot of the hills, acquire in autumn and early winter a purplish tint from the characteristic colour of the stems and spikelets.

The grass is remarkable for the spathulate pedicels of the pedicelled spikelets. These are flattened, with translucent centres surrounded by thickened margins. Another novelty is the absence of an awn. The upper lemma, which is sometimes absent, is merely the translucent base of the absent awn. A remarkable grass which might easily have been made the type of a new genus.

A NEW DICHANTHIUM FROM BURMA.

N. L. Bor.

Dichanthium theinlwinii *Bor*, sp. nov., *D. caricoso* A. Camus similis, sed ab eo racemo singulo, spicularum paribus sex infimis exaristis sterilibus distinguendum.

Gramen perenne (?), glaucescens. *Culmi* ultra 50 cm. alti, recti vel geniculatim adscendentes, graciles, teretes, glaberrimi, e nodis ramosi, laeves vel indistincte striatuli. *Foliorum laminae* usque 20 cm. longae, superiores multo breviores, lineari-acuminatae, in apicem filiformem longe attenuatae, basi nonnihil rotundatae, planae vel plerumque plicatae vel tortae vel involutae, supra pilis sparsis mollibus albidis e tuberculis ortis tectae, infra glabrae, scabrae, marginibus scabrae, adscendentes, haud patulae ; *foliorum vaginae* arcte complectentes vel demum sursum hiantes vel laxae, laeves glabraeque ; *ligulae* breves, 0·5–1 mm. longae, marginibus ciliatae.

Inflorescentia monostachya ; rhachis curvata vel recta, ejus internodia 2–2·5 mm. longa, angulata vel paene teretia, angulis brevissime ciliata, sub apice leviter incrassata ; pedicelli similes sed breviores, 1·5 mm. longi. *Spiculae* imbricatae, eae parium sex infimorum homogamae, homomorphae, exaristae. *Spiculae sessilis* hermaphrodita, 5 mm. longa, dorso visa elliptico-obovata, apice rotundata, leviter apiculata. *Gluma inferior* 4·5 mm. longa, explanata oblonga-obovata, 2·5 mm. lata, 11-nervis, nervis inferne obscuris, carinis longe ciliata, parte dimidia inferiore adpresse pilosa, marginibus angustis hyalinis inflexis ; *gluma superior* inferiori subaequalis, nonnihil longior, explanata elliptico-oblonga, acuta, 3-nervis, marginibus ciliata, carinis rotundatis ciliata. *Anthoecium inferum* vacuum ; *lemma* 4·25 mm. longum, anguste elliptico-oblongum, obtusum, 1-nerve, marginibus ciliatum ; *palea* nulla. *Anthoecium superum* hermaphroditum ; *lemma* ad basin aristae validae tortae redacta, 3·5 mm. longum, 1·25 mm. latum, anguste elliptico-oblongum ; arista 30 mm. longa, geniculata ; columna brunnea, torta, scabra. *Antherae* tres, 3·5 mm. longae ; *lodiculae* duae, bidentatae ; *styli* duo, 2 mm. longi ; *stigmata* duo, plumosa, 2 mm. longa. *Spicula pedicellata*, 5·5–6·5 mm. longa, pedicello 1·5 mm. longo insidens ; *pedicellus* basi barbatus et altero margine ciliatus. *Gluma inferior* oblongo-obovata, 5–6 mm. longa, multinervis (circiter 20), apice obtusa, nonnihil apiculata, margine angustissima, alata, ciliata, inferne dorso hirsuta ; *gluma superior* 6 mm. longa, anguste elliptico-acuta, bicarinata, 3-nervis, carinis ciliata scabraque, marginibus pilosa. *Anthoecium inferum* vacuum ; *lemma* 5 mm. longum, late ellipticum, hyalinum, marginibus ciliatum ; *palea* nulla. *Anthoecium superum* masculum ; *lemma* hyalinum, 4·5 mm. longum, lanceolatum, apice fissum ; *palea* ad squamam angustissimam 3 mm. longam apice ciliatam redacta. *Antherae* tres, 3·5 mm. longae ; *lodiculae* duae, cuneatae, apice bidentatae.

Burma. Tanlugon Rest House, Zigon Forest Division, 6 April 1940, *U Thein Lwin.* (Typus in Herb. Kew. et in Herb. Dehra Dun).

Sporobolus capillaris *Miq.* The type sheet of this specimen is no. 3309 in Arnott's Herbarium now at Glasgow. The sheet bears the name *Vilfa capillaris* in Arnott's handwriting, but this name was never published. Miquel, however, described the grass as *Sporobolus capillaris* in Verh. Konin. Nederl. Inst. **3,** pt. 4, 37 (1851). In the Flora of British India (**7,** 252 : 1896) this name is sunk in synonymy under the name *Sporobolus pulchellus* R. Br. What passes as *S. pulchellus* R. Br. in that work is actually very different from the true *S. pulchellus*, which is an Australian plant. It is also very different from *S. capillaris* from which it differs in the shape of the leaves, measurements of certain parts of the spikelet, but particularly in the shape of the grain which is disc-like in *S. capillaris* but 4-angled in the other. The latter has been described as a new species under the name *S. tetragonus* Bor, in this number p. 251.

S. capillaris Miq. is very common in the western parts of India and it is not strange to find that it has been described under another name. It was described under the name *S. scabrifolius* Bhide in Jour. and Proc. Asiat. Soc. Beng. n.s. **8,** 312 (1912) by Bhide who does not appear to have been aware of Miquel's name.

N. L. Bor.

GLAUCOSCIADIUM : A NEW MEDITERRANEAN GENUS OF UMBELLIFERAE.

B. L. Burtt and P. H. Davis.

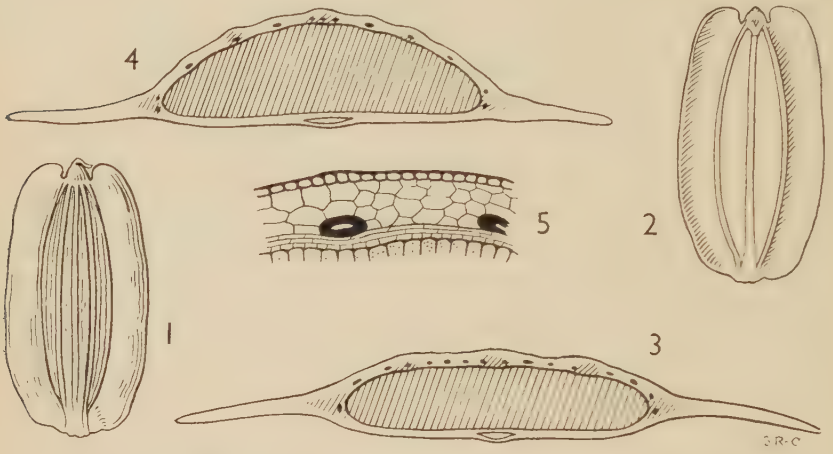
In 1888, in the Supplement to his Flora Orientalis, Boissier described the species *Siler* (?) *cordifolium* from material collected by himself on Mt. Cadmus in Caria and by Péronin near Ermenek in Cilicia Trachea. Fruits were not known at that time, and hence Boissier was doubtful as to the generic position of the plant. The next record for this species came when Post discovered it in Cyprus, probably in 1894. Post may have seen Boissier's material when identifying his specimen, but, as there are certain small discrepancies between the Cyprus plant and Boissier's original description, we have sent a more recent Cyprus specimen to Geneva and the identity has been kindly confirmed for us by Dr. Becherer. Fruits were still unknown to Post, to Holmboe in 1914 and to Thellung in 1925. Copious fruiting material was collected on Cyprus in 1937 by Mrs. E. W. Kennedy, and Jackson & Turrill (Kew Bull. 1938, 465) have already noted that the fruit-characters clearly exclude the species from *Siler* ; they suggested that it should either be removed to *Ferula*, or made the type of a new genus. The more detailed investigation now carried out confirms that *Siler* (?) *cordifolium* Boiss. must be ranked as an independent genus, which we have named *Glaucosciadium*. Its closest affinity is with the large genus *Peucedanum* L.

The first step in this investigation was necessarily to establish the type-species of the genus *Siler*. A considerable tangle of nomenclature used to surround this name, but fortunately it was elucidated by Thellung (see Le Monde des Plantes, no. 38 153, 4 : 1925). It is sufficient to repeat here that *Laser* Borkh. is the correct name for the genus referred to as "*Siler* Scop." or "*Siler* Crantz" by many authors, and its type-species is *L. trilobum* (L.) Borkh. The first publication of the genus *Siler* was by Philip Miller in 1754 (Gardener's Dictionary, ed. 4); the type-species is *S. montanum* Crantz (*Laserpitium siler* L.). *Siler* Mill. is retained as a genus distinct from *Laserpitium* L. by Thellung (in Hegi, Illustrierte Flora von Mittel-Europa, **5,** pt. 2, 1467 : 1926).

The genus *Laser* is probably monotypic. The association of *L. divaricatum* (Turcz.) Thellung with *L. trilobum* is not warranted, for the narrow leaf segments and habit of the former are utterly dissimilar, and the absence of the characteristic secondary ribs is an important technical difference. Turczaninow originally placed this species in the genus *Stenocoelium* Ledeb., but its position needs reinvestigation : it may be possible to include it in *Peucedanum*, though the habit of using that genus as a general dumping ground is to be discouraged.

Thellung made the combination *Laser cordifolium* (Boiss.) Thellung without seeing any specimens. The material now available shows that this species has a much compressed, weakly ribbed fruit with well developed marginal wings which rise up round the conical style base ; there is a variable number (9–16) of slender, irregularly placed vittae on the dorsal side, but commissural vittae are completely absent. In contrast to this, the fruit of *Laser trilobum* is only slightly compressed, strongly ribbed, wingless and provided with a broad dome-shaped stylopodium ;

there are 4 dorsal vittae lying singly between the strongly developed primary ribs and immediately below the more weakly developed secondary ones ; commissural vittae are also 4 in number. These differences are sufficient to show that the two species cannot be considered congeneric.



Glaucosciadium cordifolium (Boiss.) Burtt et Davis. 1, mericarp, outer surface, × 3 ; 2, mericarp, inner surface, × 3 ; 3 & 4, transverse sections of 2 mericarps to show variation in number and arrangement of vittae, × 12 ; 5, transverse section through outer wall of mericarp to show details of position of vittae, *much enlarged.*

A wide search through the genera in this part of *Umbelliferae* failed to bring to light any precise affinity for our plant ; a few cases of superficial resemblance were found (see below), but the only general relationship which could be established was with *Peucedanum* L. and its close allies. In addition to the fruit characters mentioned above, some salient features of *Glaucosciadium* to which we have paid particular attention are the following :—the vertical root is branched above into rhizomes spreading laterally and bearing scale-leaves ; there is no crown of fibres formed from the decaying leaf-bases of the radical leaves ; the whole plant is strongly glaucous ; the leaflets are broadly ovate with thickened entire margins ; the stem is more or less smooth and possesses solid pith.

It is very difficult to generalise about the genus *Peucedanum*, of which *P. officinale* L. may be taken as the standard species (Green and Hitchcock in Proposals by British Botanists for International Botanical Congress, Cambridge 1930, 139 : 1929). Even when certain groups such as *Pastinaca* L. and the American *Lomatium* Rafin. are excluded, *Peucedanum* remains a vast assemblage of Old World species which shows a wide range of general facies and a considerable variation in the details of fruit-structure. In this group generic and subgeneric limits are greatly in need of re-definition.

We have examined all the material of *Peucedanum* in the Kew Herbarium and in every species we have found that commissural vittae are present. Only in *P. renardi* Regel & Schmalh. do they fail to reach to the base of the mericarp, a condition that is normal in *Pastinaca* L. and *Heracleum* L.

Whether this can be regarded as a step towards their complete disappearance is doubtful, as in these three examples the commissural vittae, though not running the full length of the mericarp, are very conspicuous. The genus *Steganotaenia* Hochst., which is also closely allied to *Peucedanum*, has fruits in which no vittae at all are developed. Its species are arborescent plants of tropical Africa, have simply pinnate leaves and are certainly less closely allied to *Glaucosciadium* than is *Peucedanum* itself.

We conclude from this survey that the presence of commissural vittae is a character of considerable generic constancy and therefore important and reliable taxonomically. By the absence of commissural vittae *Glaucosciadium* may be surely isolated from *Peucedanum* and the other genera closely allied to it. The further generic characters of *Glaucosciadium* are derived from the association of those salient features which have been mentioned above ; individually these characters appear occasionally in *Peucedanum*, but we have not found them associated together in any species of that genus ; they combine to give *Glaucosciadium* a most distinctive facies.

The genus *Ormosolenia* Tausch is now usually included in *Peucedanum*, and this treatment is probably unavoidable until the limits of the latter genus are thoroughly investigated ; then the claims of *Ormosolenia* to generic rank may perhaps be upheld. Certainly the two species concerned—*Peucedanum alpinum* Sieber ex Schultes, Burtt & Davis* (from Crete and *P. pisidicum* (Boiss. et Heldr.) Boiss. (from S.W. Anatolia)—are very distinct from the rest of the genus, and it is possible that they represent an affinity with *Glaucosciadium*. At first sight the difference in stature between these dwarf *Peucedana* and the robust erect plant from Cyprus is so marked as to make any close relationship seem highly improbable ; but there are other vegetative features which they share. It may be mentioned that we have had the advantage of studying some fine new material of the rare *P. pisidicum*, including ripe fruits.†

P. alpinum and *P. pisidicum* resemble *Glaucosciadium* in their branched rootstocks, more or less solid (though very slender) stems, radical leaves whose petioles do not split up into fibres as they decay, and glaucous leaflets. In the fruit, however, we find well developed commissural vittae as in other species of *Peucedanum*. It is particularly interesting to note that, although *P. alpinum* and *P. pisidicum* are very close in general characters, there is quite a range of variation in carpological details. Thus *P. alpinum* has one or two vittae between the dorsal ribs and 4–6 commissurally. *P. pisidicum* has (according to Boissier's description) 3

*__Peucedanum alpinum__ (*Sieber ex Schultes*) *Burtt et Davis*, comb. nov.

Sison alpinus Sieber ex Schultes in Roemer & Schultes, Syst. Veg. **6,** 414 (1820) ; Sieber, Reise nach Kreta, **1,** 472, **2,** 317, tab. 7 (1823).

Peucedanum creticum Sprengel, Neue Entdeck. **2,** 148 (1821), et in Syst. Veg. **1,** 911 (1825) ; Boiss., Fl. Or. **2,** 1021 (1872) ; Halacsy, Consp. Fl. Graec. **1,** 641 (1901) ; Hayek, Prod. Fl. Balc. **1,** 1036 (1927) ; K. H. Rechinger, Fl. Aegaea, 413 (1943).

Sison (?) *sieberianum* DC. Prod. **4,** 111 (1830).

Ormosolenia cretica (Sprengel) Tausch in Flora (oder Bot. Zeit.) 1834, 348 in nota.

†Turkey. Prov. Antalya, distr. Kemer (Lycia) : Tahtali Dagh, 2100 m., loose scree facing north ; leaves thick glaucous, flowers pale yellowish-green, minute ; 16 Aug. 1947, *Davis* 14196.

It was at first thought likely that this material, due to apparent carpological differences and the invariably simple leaves, represented a new species distinct from *P. pisidicum* ; but Dr. Becherer has kindly compared a specimen with Boissier's original plants and reports that they are conspecific.

between the dorsal ridges and 6 commissurally, although in *Davis* 14196 the vittae between the ribs are solitary and there are only 2 on the commissure. In these species it appears that vegetative characters are less variable than are the details, though not the general form, of fruit-structure ; a similar fluctuation in the number of vittae is found in some species of *Ferula*. It may be mentioned that *P. alpinum* and *P. pisidicum* are placed by Boissier (Fl. Or. **2,** 1021 : 1872) in *Peucedanum* Sect. *Palimboidea* Boiss., the type-species of which appears to be *P. carvifolium* Vill. (*P. chabraei* Jacq.). The section is " characterised " by having 2–3 vittae lying in the valleys between the ridges, an extremely artificial classification that brings together species otherwise scarcely related and would, incidentally, exclude the new Turkish material of *P. pisidicum*.

The solid pith of *Glaucosciadium* is a somewhat unusual character in this group of genera. It is, however, also found in a few species of *Peucedanum* subgen. *Taeniopetalum* (Vis.) Thellung*, such as *P. arenarium* Waldst. & Kit., *P. neumayri* (Vis.) Reichb. fil. and their allies, which are otherwise widely separated from *Glaucosciadium* by their narrow leaf-segments and very fibrous leaf-bases.

A species in which the leaf-bases do not break up into fibres at the base, and in which the lowermost leaves are reduced to scales, is *Peucedanum ostruthium* (L.) Koch, the Masterwort. There is in this species, however, a little-branched creeping horizontal rhizome : the rootstock of *Glaucosciadium* is not creeping and is more or less vertical. *P. ostruthium*, in fact, only deserves mention as illustrating the occurrence of basal scale leaves in *Peucedanum*.

A plant which shows a much greater resemblance to *Glaucosciadium* is *Angelica strattoniana* Aitch. & Hemsl. from Afghanistan. Vegetatively, in fact, there is no significant difference to militate against their belonging to the same genus. Though the pith of the stem is not quite solid, the cavity is considerably smaller than the pith itself ; the most important discrepancy is that the leaflets are toothed. The fruits of *Angelica strattoniana* are, however, typical of its genus, the 3 dorsal ribs of each mericarp being developed into narrow wings ; commissural vittae are, of course, present.

There is a remarkable similarity in leaf-form between *Angelica strattoniana* and the Socotran *Peucedanum cordatum* Balf. fil., but in the latter the stem is quite hollow. Its fruits are more strongly ridged than is usual in *Peucedanum*, which may be interpreted as an approach to the winged ridges of *Angelica* and a character, together with the well-developed commissural vittae, dissociating it from *Glaucosciadium*. No rootstock is available for comparison.

Other species, which a superficial similarity in one or more characters has led us to compare more closely with *Glaucosciadium*, are *Peucedanum dhana* Buch.-Ham. (from India), and *Lomatium nudicaule* (Pursh) Coult. & Rose, *L. lucidum* (Nutt.) Jepson and allied species of this North American genus. The similarity of facies between these Californian *Lomatia*, the Afghan *Angelica strattoniana* and the Socotran *Peucedanum cordatum* is particularly striking. None of these trails, however, has led to any close

*In so far as they are applicable on a wider geographical basis we accept in this paper the generic limits given by Thellung in Hegi, Ill. Fl. Mitt. Eur. **5** (2), 1363 (1926).

affinity for *Glaucosciadium*, and these superficial resemblances in vegetative features may have been caused by parallel development. On the other hand, in a thorough study of this group of *Umbelliferae* the species just mentioned might possibly all be classed as relict types ; their community of vegetative features may really represent persistent characteristics of an old, and at one time more widespread, stock. Such speculation derives some support from the variation in carpological characters in *Peucedanum alpinum* and *P. pisidicum*, which are vegetatively very similar. Bentham & Hooker may have been struck by similar instances when they wrote (Gen. Pl. **1.** 861 : 1867) " genera Umbelliferarum ab auctoribus variis ad characteres futiles et quam maxime artificiales immoderate multiplicata, difficillime distinguuntur et ordinantur. Quae naturalia sunt saepe characteribus carent, et characteres e calyce petalis vittis et seminis facie sumpti species simillimas saepe longo tractu separant". We must hope that the characters of *Glaucosciadium* will not be termed futile by later workers!

Glaucosciadium *Burtt et Davis*, gen. nov. a *Peucedano* L. mericarpiis vittis commissuralibus carentibus, vittis dorsalibus tenuibus in pericarpio interiore irregulariter dispersis praesertim distinguendum. Etiam characteribus sequentibus conjunctis a *Peucedano* recedit : rhizomatibus ascendentibus ad apicem radicis crassi enatis ; caulibus solidis ; foliis infimis squamiformibus, vaginis petiolisque numquam in fibras dissolutis ; segmentis foliorum latissimis integris cartilagineo-marginatis coriaceis valde glaucis ; mericarpii alis tenuibus.

G. cordifolium (*Boiss.*) *Burtt et Davis*, comb. nov.

Siler (?) *cordifolium* Boiss. Fl. Or. Suppl. 263 (1888) ; Post in Mém. Herb. Boiss. no. 18, 94 (1900) ; Holmboe, Stud. Veg. Cyprus, 141, fig. 47 (1914) ; Jackson & Turrill in Kew Bull. 1938, 465.

Laser (?) *cordifolium* (Boiss.) Thellung in Le Monde des Plantes, no. 38–153, 4 (1925).

Perennial herb up to about 70 cm. high, strongly glaucous, with an acrid smell when bruised. *Root* vertical, dark brown, longitudinally fissured, deep-seated, supporting 1-few ascending rhizomes bearing semi-orbicular scale leaves. *Basal leaves* few (3–5), triangular-ovate in outline, up to 25 (–30) cm. long and 18 cm. broad, coriaceous, glabrous, very glaucous, sheaths ovate to oblong-lanceolate, ribbed and passing into the long striate petiole, old sheaths not breaking up into fibres, lamina pinnate with 1–3 pairs of lateral leaflets, the lowest often ternate ; leaflets ovate-orbicular, up to 7 (–8) cm. long and 5 cm. broad, unequally truncate and sometimes subcordate at the base, with radiating nerves and a pronounced webbing of reticulate venation ; shortly mucronate at the apex, margins entire cartilaginous whitish somewhat undulate. *Flowering stems* usually single from each crown, erect, laxly and sub-divaricately branched, 40–70 cm. tall, 3·5 mm. in diameter, glaucous, finely striate, the pith solid. *Lower stem-leaves* pinnate with 1–2 pairs of lateral leaflets, resembling the basal leaves but smaller. *Upper stem-leaves* reduced to ovate-oblong sheaths, the lower often drawn out into a short subulate petiole. *Umbels* compound, hermaphrodite, widely spreading, 6–13-rayed ; rays somewhat unequal, 1–3·5 cm. long, 0·5 mm. broad, rising from the knob-shaped apex of the common peduncle. *Involucre* poorly

developed, consisting of a few triangular-subulate (often deciduous) scales. *Involucel* more or less obsolete. *Flowers* 15–25 in each umbellule, the outer 2–8 fertile on spreading pedicels 2–4 mm. long, the inner abortive, on very short pedicels. *Calyx* absent. *Corolla* regular, dirty white ; petals broadly ovate, acuminate, strongly incurved, webbed on the adaxial side, 1 mm. long. *Filaments* 1·25–1·5 mm. long ; anthers orbicular. *Ovary* 1 mm. long ; styles 0·5 mm. long, surmounting the large dome-shaped stylopodium. *Mericarps* elliptical, much flattened dorsiventrally, 10–12 mm. long, 5–6·5 mm. broad, 0·75 mm. thick, finally separating below from the carpophore ; dorsal ridges 3, slender, not prominent, about 0·75 mm. apart ; lateral ridges often slightly more distant from the dorsal ones, extending into a spreading wing ; wing 1–1·5 (–1·75) mm. wide, slightly tumid on the inner side but spreading into a thin flat margin, crossing the seed at the base and obscurely notched, at the apex rising sharply on either side of the persistent (0·75 mm. long) stylopodium, but scarcely overtopping it ; pericarp thin, especially on the commissure ; dorsal vittae 9–16, very slender, round or somewhat flattened, irregularly scattered on the inner side of the pericarp both beneath and between the ridges and often related to shallow depressions in the albumen, those running singly below the lateral ridges appearing faintly near the top of the commissural suture ; commissural vittae absent ; albumen slightly concave on the commissural side, light grey. *Embryo* small, straight, lying near the top of the albumen.

Turkey. Lower regions of Mt. Cadmus, above Denisleh and Mesogis near Dervent (Caria) ; *Boissier* (sterile—not seen). In mountains near Ermenek (Cilicia Trachea), *Péronin* (fl.—not seen).

Cyprus. Aphamis ; 900 m. ; limestone mountain, among garigue of *Genista sphacelata* and in vineyards; flower stalk has a bitter smell, herds crop only the young buds ; mericarp purple with white wings ; more plentiful than at 1050 m. ; 21 Aug. 1937, *Kennedy* 675. *Ibidem*, the vineyards had been cleared and the garigue about as far as might be ; the seed was dry and dropping, no rain had fallen and the ground was baked like a brick ; 2 Oct. 1937, *Kennedy* 675 a. Platres ; 1200 m. ; igneous rock ; a few plants on a shady slope towards a rain galley under pine trees and among bracken ; 29 Sept. 1937, *Kennedy* 676. Platres—Mesopotamos ; 1170 m. ; vineyard, among pine trees and garigue ; 17 Oct. 1938, *Kennedy* 1389. Aphamis ; 1080 m. ; limestone mountain ; vineyard ; young leaves dark green and red, with the look of young leaves of a garden rose; 21 April 1939, *Kennedy* 1390 a. Platres; 1200 m.; bank of a ravine among pine trees ; 17 Oct. 1938, *Kennedy* 1399. Perapedhi; vineyards in chalky marl; also on hillsides with *Scabiosa cypria* ; 12 July 1940, *Davis* 1835. Platres ; 1200 m. ; in vineyards, scarce ; leaves glaucous ; 12 July 1940, *Davis* 1848. Aphamis, above Perapedhi ; 1000 m. ; in vineyards on steep chalky hillsides ; glaucous perennial ; fls. creamy white ; 23 Oct. 1939, *Davis* 1978. These localities are all on the S. side or at the S. foot of the Troödos massif.

ADDITIONS TO THE WILD FAUNA AND FLORA OF THE ROYAL BOTANIC GARDENS, KEW : XXI.*

(Edited by H. K. Airy Shaw)

Corrections to Supplement XX (*K. B.* **1948,** 113)

P. 113, l. 11 up : *after* Phanerogams *insert* Vascular Cryptogams.

P. 114, l. 8 down : *before* Algae *insert* Vascular Cryptogams.

Pp. 114–115 : in Subject-index, *for* XIII *read* XII throughout, except under Ceratostoma, Chaetomium and Fungi.

P. 115, Subject-index : *after* Tropical Cockroaches—VI *add* Vascular Cryptogams—VII, XII.

Miscellaneous Records, 1947–8.

As in Supplement XX, an asterisk (*) indicates introduced species ; square brackets enclose records from just outside the Gardens, and also page references to earlier records in the original " Wild Flora and Fauna " [F.] and subsequent Supplements [I, II, etc.]. Unsigned records and determinations are the compiler's (H. K. A. S.).

We are grateful to Dr. J. W. Landells for his notes under Mammalia and Aves.

FAUNA

Vertebrata

MAMMALIA

Mustelidae

Lutra lutra (L.). The Otter. On Dec. 13th 1948 the resident Keeper of the birds, Mr. J. Claiden, showed me, among the thick reeds on the small island in the pond, about 8 eels half eaten, a three pound carp partly eaten, and the head and part of the body of a tame pintail duck. It is almost impossible to think of any alternative explanation of this holocaust to the activities of an otter. No tracks were visible, and although a careful watch was kept nothing further has transpired to date.

Fitter (*London's Natural History*, 196 : 1945) records an otter on Syon House marsh in August 1937.—J. W. Landells.

AVES

[See also J. W. Landells in *Birds in London* (Ministry of Works : Report by Committee on Bird Sanctuaries in Royal Parks, 1939–47), 26–27 (1948).]

Motacillidae

Motacilla c. cinerea Tunst. Grey Wagtail. One, 1 Feb. 1948 (*J. A. Bayley*). [XVIII. 62].—J. W. Landells.

Paridae

Parus ater britannicus Sharpe & Dress. A Coal-tit was seen entering and emerging from a hole in the Rockery, by the stream, 7.iv.48

*Continued from *Kew Bull.* **1948,** 124 (1948).

(*H. K. A. S.*) and again on 14.iv.48 (*E. Milne-Redhead & P. Taylor*). Said also to have been seen there in 1947 by Mr. H. N. Ridley, *teste* G. Preston.

BOMBYCILLIDAE

Bombycilla g. garrulus (L.). The Waxwing. During the hard weather of early 1947, when there was a big irruption of these visitors to Great Britain, one was picked up by *Constable G. Ware* on 23rd March but died next day. Two were seen on 25th March 1948 (*Dr. H. M. Muir-Wood*).—J. W. L.

TURDIDAE

[**Oenanthe oe. oenanthe** (L.). The Wheatear. A pair on the golf course adjoining the southern boundary, 2 Sept. 1948 (*A. F. Kedge*).] [XVIII. 64].—J. W. L.

PICIDAE

Iÿnx t. torquilla L. The Wryneck. One, 25 March 1948 (*Dr. H. M. Muir-Wood*). [F. 8 ; XVIII. 64].—J. W. L.

CUCULIDAE

Cuculus c. canorus L. A young Cuckoo was seen on some railings by the Herbarium, being fed (? with cabbage-white larvae) by a pair of dunnocks (*Prunella modularis occidentalis* (Hart.)), 0815 h. GMT, 31.vii.47.

PHASIANIDAE

Alectoris rufa (L.). The Red-legged Partridge. One found in the Mortlake Road and brought to the Curator's Office on 23 June 1948 was liberated in the Queen's Cottage grounds and has lived there since.—J. W. L.

PODICIPITIDAE

Podiceps r. ruficollis (Pall.). A Little Grebe was seen on the Pond on 21.xi.48 (*E. Milne-Redhead*). Whilst this bird is not uncommon on the Lake, where it breeds regularly, it has not previously been recorded for the Pond.—E. M.-R.

Invertebrata

MOLLUSCA

B. VERDCOURT

The following are new to Kew and the Planorbids have not been introduced into Britain before (?).

ZONITIDAE

***Zonitoides arboreus** (Say). In connection with Dr. Meeuse's record of this species from Kew [XX. 120], it may be of interest to note that snails referable to this species have been found at Glasnevin and Belfast (Ellis, *British Snails*, 241 : 1926), and also at Edinburgh (Ellis *in litt.*). I have received many specimens of this American species from Dr. Stirling, found in his greenhouse at Northwich, Cheshire.

LYMNAEIDAE

Lymnaea truncatula (Müll.). Small specimens of this species were found to be common on wet pebbles in the Tropical Pits and also in the fern house (Oct. 1948). During November, however, none could be found. Several specimens were dissected and some of these showed an interesting abnormality in their radulae, the teeth being tricuspid instead of unicuspid as is usual in the Lymnaeidae. A note on this is to be published in the *Journal of Conchology*.

PLANORBIDAE

Two species of this family were found plentifully in a tank in the Tropical Pits in October 1948. The names of these two species are still in some doubt, since adults have only recently been found (March 1949) and not yet examined. Mr. J. R. le B. Tomlin has kindly examined the juveniles and considers them to be ***Planorbis liebmanni** Dunker [=**Tropicorbis orbiculus** (Morelet) in Baker's Monograph†], and ***P. trivolvis** Say [=**Helisoma trivolvis** (Say) in Baker's Monograph†]. Dr. H. A. Pilsbry of Philadelphia has also kindly examined the material and suggests that the species are ***Helisoma duryi** (Wetherby) and ***H. eudiscus** Pilsbry (this is considered a subspecies of *duryi* by Baker†), both of which are natives of Florida. *Helisoma* is a generic split from the large group *Planorbis* and contains a large number of closely related and variable species.

DIPLOPODA

***Odontopyge** sp. A large millepede found among the roots of an orchid from East Africa, 2.ix.48, by *S. W. Stanton*, was referred provisionally to this genus by Mr. E. Browning of the British Museum. The specimen was then forwarded to the Zoo for exhibition in the Insect House, with the request that at death the corpse might be returned to the Museum for preservation and definite identification!

ARACHNIDA
CHELONETHI (PSEUDOSCORPIONES)

CHTHONIIDAE

Chthonius orthodactylus Leach. One under pot in Tropical Pits (18C), 29.x.48, *B. Verdcourt*. Kindly named by Mr. E. Browning of the British Museum.

INSECTA
HEMIPTERA—HETEROPTERA

CYDNIDAE

Sehirus bicolor L. [One on path over Kew Green, 9.v.47, *E. Milne-Redhead*] ; one on *Lamium album* by tennis courts behind Kew Palace, 13.v.47.

ARADIDAE

***Neuroptenus caffer** Stål. A colony of these curious flattened bugs

†Baker, F. C., *The Molluscan Family Planorbidae*. Urbana, 1945.

was found under the bark of a piece of wood upon which an East African orchid was growing, received by air from Mombasa, 2.ix.48, *S. W. Stanton*. Kindly named by Mr. W. E. China of the British Museum. The species is said to be a common one.

SALDIDAE

Saldula saltatoria L. One running over pebbles on shelf in Tropical Pits, 18.x.48. A most unexpected place in which to find this common 'mud-hopper'.

LEPIDOPTERA

SPHINGIDAE

Macroglossum stellatarum L. A Humming-bird Hawk-moth was seen on the wing in the Herbaceous Ground on 12th March 1948 (see H. K. A. S. in *Ent. Mon. Mag.* **84,** 129 : 1948). It was no doubt a hibernated example, of which a number of others were reported from different parts of the country at about the same time.

NOTODONTIDAE

Pheosia tremula Clerck. Larva of the Sharp-wedged or Swallow Prominent on *Populus trichocarpa* by old bowling-green, 12.vi.47 ; egg seen previously. First record for the Gardens.

HYDRIOMENIDAE

Gymnoscelis pumilata Hubn. (Garden or Double-striped Pug) [III. 170], ab. **rufo-fasciata** Haworth. In the Herbarium, 14.vi.48.

PYRAUSTIDAE

Eurrhypara hortulata L. One in Herbarium, 29.iii.47, *R. A. Blakelock*. Possibly an early emergence from a larva that had found its way into the building the previous year and pupated there. The larva is a nettle feeder. Another specimen, *ibid.*, 13.vi.47. [F. 40, as *E. urticata* L.].

COLEOPTERA

CARABIDAE

Acupalpus meridianus L. By tennis-courts behind Kew Palace, 9.v.47.

[**Calathus melanocephalus** L. One at roots of herbage, allotments, Kew Green, 27.iii.47, *E. Milne-Redhead*].

SILPHIDAE

Necrophorus humator F. One under large fungus lying on ground outside Herbarium, 24.ix.48, *A. A. Bullock*.

[**Thanatophilus sinuatus** F. One on 'dog-walk', Kew Green, 19.x.48, *B. Verdcourt*.]

STAPHYLINIDAE

[**Tachinus subterraneus** L. One on 'dog-walk', Kew Green, 18.iii.47.]

RHIZOPHAGIDAE

Rhizophagus sp. Several seen flying by tennis pavilion behind Kew Palace, 13.v.47, but not captured.

PTINIDAE

Ptinus sexpunctatus Panz. One on window-ledge of Herbarium, 27.v.47, *B. L. Burtt.*

MALACHIIDAE

Malachius bipustulatus L. One in Herbarium Experimental Ground, 21.iv.48. [VII. 121].

CRYPTOPHAGIDAE

Cryptophagus sp., probably **validus** Kr. or **dentatus** Herbst. On window of Herbarium, 3.ix.48.

LYCTIDAE

Lyctus brunneus Steph. One in Herbarium, 6.ix.48, *A. Sapper.* The powder-post beetle is a serious pest of timber. [XII. 367].

LATHRIDIIDAE

Cartodere filum Aubé. One in bundle of specimens, Herbarium, 13.vi.47 ; many more in bundle, 30.vii.47, and again in 1940, with many teneral individuals. Apparently well established in the Store, feeding on the mould on slightly damp specimens, but not injuring the specimens themselves. (XX. 118, which see.]

Corticaria fulva Comolli. Several in Herbarium Store, 24.xi.48, *J. Kennedy O'Byrne.*

SCARABAEIDAE

Gnorimus nobilis L. A specimen was found in the gardens and brought to Dr. C. R. Metcalfe, 5.vi.47. [F. 222 ; XX. 117, which see.]

[**Aphodius luridus** F. One on 'dog-walk', Kew Green, 2.iv.47, *R. D. Meikle.*]

[**Aphodius scybalarius** F. One flying by 'dog-walk', 19.iv.47.]

CERAMBYCIDAE

Prionus coriarius L. One on path from Herbarium to tennis courts, 26.viii.48, *Miss A. Milne-Redhead.* [F. 26]. An interesting find ; this fine Longicorn does not seem to have been seen at Kew for many years.

CHRYSOMELIDAE

[**Chrysolina marginata** L. One, freshly crushed, on path over Kew Green, 18.iii.47. Dr. S. Maulik, of the British Museum, has kindly drawn my attention to a note on this scarce species by W. A. Forbes in *Ent. Mon. Mag.* **12,** 135 (1875), in which it is shown that its food-plant is probably *Achillea millefolium.* This is not stated in the standard works on British Coleoptera. Some plants of milfoil were in fact growing on the allotments a few feet from where the beetle was found.]

Phyllodecta vitellinae L. One on leaf of *Populus trichocarpa* by tennis-courts behind Kew Palace, 13.v.47, *E. Milne-Redhead.*

BRUCHIDAE

***Callosobruchus chinensis** (L.). In Leguminous seeds in Museums, several generations bred, 1947–8, *F. N. Howes*. Kindly named by Dr. H. E. Hinton of the British Museum. A cosmopolitan species. (XII. 367]

CURCULIONIDAE

Apion miniatum Germ. On *Rumex* by tennis-courts, 13.v.47 ; one on wall by Herbarium, 3.xi.48. This common and conspicuous species has not previously been recorded from the Gardens.

HYMENOPTERA

VESPIDAE

Vespa crabro L. A queen hornet was found in the tool-shed of the Herbarium experimental ground in perfect condition, 2.iv.48, *W. A. Mullins*. A worker was seen carrying off a large Syrphid from ivy bloom by the Succulent House, 8.ix.48, *E. Milne-Redhead & H. K. A. S.* The hornet has not hitherto been recorded from the Gardens.

Vespula germanica L. A queen in the Herbarium, 5.iv.48. " New " to the *Wild Fauna and Flora* (*V. vulgaris* L. was noted in XII. 369).

DIPTERA

SYRPHIDAE

Volucella zonaria Poda. About 8 on ivy bloom by Succulent House, 24.viii.48, *R. D. Meikle & P. Taylor* ; 2, *ibid.*, 6.ix.48, *J. P. M. Brenan & H. K. A. S.* ; about 6, *ibid.*, 8.ix.48, *E. Milne-Redhead & H. K. A. S.* [XX. 118; which see.]

FLORA

Phanerogamia

ANGIOSPERMIA

CARYOPHYLLACEAE

***Corrigiola telephiifolia** Pourr. Two or three plants in turf where old beech tree had recently been removed at E. end of birch collection, flowering 17.x.47, *S. Ross-Craig*.

No previous record for this species in Britain has been traced. Hegi (*Ill. Fl. Mittel-Eur.* **3,** 427 : 1911) records that it has been found as an alien in Belgium and Germany. Its normal distribution is S. France and Mediterranean.—B. L. BURTT.

COMPOSITAE

Anthemis nobilis L. [F. 82] var. **discoidalis** Heslop Harrison. " Dry grassy places, Kew " (Salmon, *Fl. Surrey*, 387 : 1931) ; still there, 1941–2, *N. Y. Sandwith*.

RICCIACEAE

Riccia sorocarpa Bisch. On soil of pots in Herbaceous Yard, 12.ix.48, *P. Taylor*. (Det. P. Taylor).

Riccia glauca L. On damp soil, Tropical Pits, ii. 1912, *C. H. Wright* (note in Kew copy of *Wild Fauna and Flora*).

Cryptogamia

FUNGI

R. W. G. Dennis

BASIDIOMYCETAE (HOMOBASIDIEAE)

AGARICALES

AGARICACEAE

***Lepiota tenella** Boud. (*L.* "*Brebissoni*" auctt.). On soil of pot in Tropical Pits, 20.v.47.

Lepiota haematosperma (Bull. ex Fr.) Boud. On bare soil of Aroid House, 24.vi.48, *E. Milne-Redhead* ; *ibid.*, 18.x.48, *H. K. A. S.*

Lepiota rufescens (B. et Br.) Lange. On bare soil, Aroid House, 18.x.48.

Hygrophorus sciophanus Fr. In some numbers in short grass by tennis courts, with a few *H. psittacinus* Schaeff. ex Fr. [F. 114], 7.ix.48.

***Mycena osmundicola** Lange. Growing gregariously on compost of pots in Tropical Pits, 10.ii.48.

Omphalia fibula (Bull. ex Fr.) Quél. One in moss in frame, Herbaceous Yard, 14.ix.48. [F. 112]

?**Conocybe spicula** Ricken apud Kühner (non *Galera spicula* Fr.). One by tennis courts, 11.ix.48.

Coprinus plicatiloides Buller (*C. curtus* Kalchbrenner *sensu* Lange). On soil in pot of *Streptocarpus caulescens* seedlings in Tropical Pits, 17.iv.47.

APHYLLOPHORALES

CLAVARIACEAE

[**Typhula candida** Fr. On fallen leaves of *Populus alba*, Kew Green, 3.xi.48, *Miss E. M. Wakefield.*]

THELEPHORACEAE

Corticium Rolfsii Curzi. See *Sclerotium Rolfsii* Sacc., below.

ASCOMYCETAE

DISCOMYCETALES

PEZIZACEAE

Aleuria repanda (Karst.) Boud. A fine large specimen found growing on floor of car kept in open shed outside Herbarium, 15.ii.48 !

Pustularia catinus (Holmskj. ex Fr.) Fckl. Under beeches near Queen's Cottage, viii. 1920, *W. B. Grove*. This record has not hitherto been published.

HELOTIACEAE

Helotium calyculus (Sow. ex Fr.) Fr. [*H. virgultorum* (Vahl ex Fr.) Fr.] On dead wood of compost under fern, Fern House, 4.xi.48. [F. 155 ; XII. 377]

FUNGI IMPERFECTI

MUCEDINACEAE

Cephalosporium acremonium Corda. On (probably) dead white-fly (*Aleyrodidae*), in masses on undersides of leaves of *Eranthemum purpurascens* Wight ex Nees in propagating house, 25.xi.47.

STILBACEAE

Stilbum turbinatum Tode ex Fr. Scattered over one of three 2 ft. high bamboo canes in a pot of *Dioscorea* in Tropical Pits, c. 15.x.–20.xi.48. [F. 181]. *S. sphaerocephalum* Massee, described from wounds on *Philodendron* stems in Aroid House, 1907 [see IV. 243], is probably the same.

MYCELIA STERILIA

***Sclerotium Rolfsii** Sacc. On soil of pot containing rotting seed of *Entada scandens*, in Tropical Pits, 1947. The perfect stage of this fungus is *Corticium Rolfsii* Curzi, but only sclerotia were seen at Kew. It is a dangerous parasite of tropical crops.

Botany of the Canadian Eastern Arctic : Part II :—*

Botany of the Canadian Eastern Arctic planned to appear in four parts is the culmination of Dr. Polunin's study of the Arctic flora over the last 15 years or more. He was entirely responsible for the first part which covered the Pteridophyta and Spermatophyta and appeared in 1940. In this second volume dealing with the non-vascular Cryptogams he has written the section of Hepaticae, but the other groups are dealt with by the following specialists :—R. W. Whelden (Algae, excluding Phytoplankton), D. H. Linder (Fungi), G. Seidenfaden (Marine Phytoplankton), R. Ross (Freshwater Diatomeae), B. Lynge (Lichenes), and W. C. Steere (Musci).

That part of the Arctic under review lies more or less north of 60° Lat. and east of 95° Long., excluding Greenland, and is shown on a sketch map divided up into 10 areas for purposes of citation and comparison. There is also a loose map giving details on the scale of 1 inch to 100 miles. Particulars of collecting stations which are given in the first volume are not repeated in the second.

The introduction outlines a chronological history of relevant Cryptogamic investigation. In the main body of the work the aim has been to include all reliable records and this has been accomplished for all groups except the Fungi and a section of the Algae. Licehnologists will be interested to note that one of the largest and most valuable lichen collections from the Arctic, that made by Dr. H. G. Simmons on the Second Norwegian Arctic Expedition in the Fram, has had to be left out of consideration because of the unreliability of the determinations. The treatment of species conforms as far as possible to that in Part I. Each group has an interesting introductory survey and each is rounded off with an adequate bibliography. Altogether 26 new species are described occurring in the following groups :—Algae (17), Fungi (7), Lichenes (2).

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*Botany of the Canadian Eastern Arctic : Part II. Thallophyta and Bryophyta. Compiled and Edited by Nicholas Polunin. National Museum of Canada, Bulletin No. 97, 1947. Pp. 573, 18 plates, 1 map. Price $1.

The whole is summarised in a series of tables showing the distribution of species in the 10 major areas.

In a book which is likely to be of considerable importance as a work of reference for many years it seems a pity that more care was not devoted to ensuring that the nomenclature was up to date, and would certainly expect the classification to be that which is now accepted by the majority of systematists. The section on Marine Algae provides examples which show that this part at least must be approached with caution in these respects. One can point to *Ahnfeltia plicata* which is placed in the *Phyllophoraceae*, and *Delesseria sinuosa* now universally put into the *Nitophylleae* in the genus *Phycodrys*. This latter also brings up the question of nomenclature and it has to be admitted that algal nomenclature remains in a state of chaos. De Toni's Sylloge Algarum (1900) familiarised the name *Delesseria sinuosa* while *Phycodrys rubens* came into use in this country after the publication of Batter's Catalogue of British Marine Algae (1902). Since Kylin's work on the *Delesseriaceae* 25 years ago *Phycodrys* has been the accepted genus but to the present day leading authorities variously use the combinations *P. rubens* and *P. sinuosa* for this well known species.

A word must be said about general (i.e. world) distribution. Dr. Whelden seems to interpret this in the same way as the editor (p. 6) as appears from his description of some of the widely distributed species, and if this is so then the information on this subject is far from reliable. For example under *Ralfsia verrucosa* and *Hildbrandtia prototypus* the general distribution is given as Circumpolar ; "Circumpolar" no doubt it is but this leaves much to the imagination in speaking of plants which are common in the Mediterranean. Then with regard to habitat on p. 21 *Aphanocapsa arctica* n. sp. is described as from Clyde but without further detail than that it is to be found in vial 151. Is it from fresh-water, salt-water or neither ?

The mumerous editorial footnotes tend to become a hindrance rather than a help and are wearisome to the reader. It is a pity that they were found to be necessary, but as indicated in the foreword the book was produced in difficult circumstances. Though it was completed in 1939 printing had to be delayed until after the cessation of hostilities. In spite of the flaws a good deal of information is supplied, and in some sections there is considerable discussion. Cryptogamists will undoubtedly welcome it as a useful work of reference on the Thallophyta and Bryophyta of the Arctic.

C. I. Dickinson.

Nomina nova Poarum indicarum.

Poa stapfiana *Bor*, nom. nov. Syn. *P. tremula* Stapf in Hook. f., Flor. Brit. Ind. **7,** 344 (1896) non *P. tremula* Lam., Tab. Encycl. Meth. **1,** 185 (1797) nec *P. tremula* Schur. in Verh. Siebenb. Ver. Naturw. **4,** 86 (1853).

Poa pagophila *Bor*, nom nov. Syn. *P. flexuosa* of the Flor. Brit. Ind. **7,** 342 (1896) non *P. flexuosa* Sm., Flor. Brit. 101 (1800) nec *P. flexuosa* Schleich. ex Gaud. in Alpina **3,** 40 (1808) nec *P. flexuosa* Wahl., Flor. Carp. Princ. 22 (1814) nec *P. flexuosa* Muhl., Descr. Uber. Gram. 148 (1817) nec *P. flexuosa* Roxb., Flor. Ind. **1,** 340 (1820).

N. L. Bor.

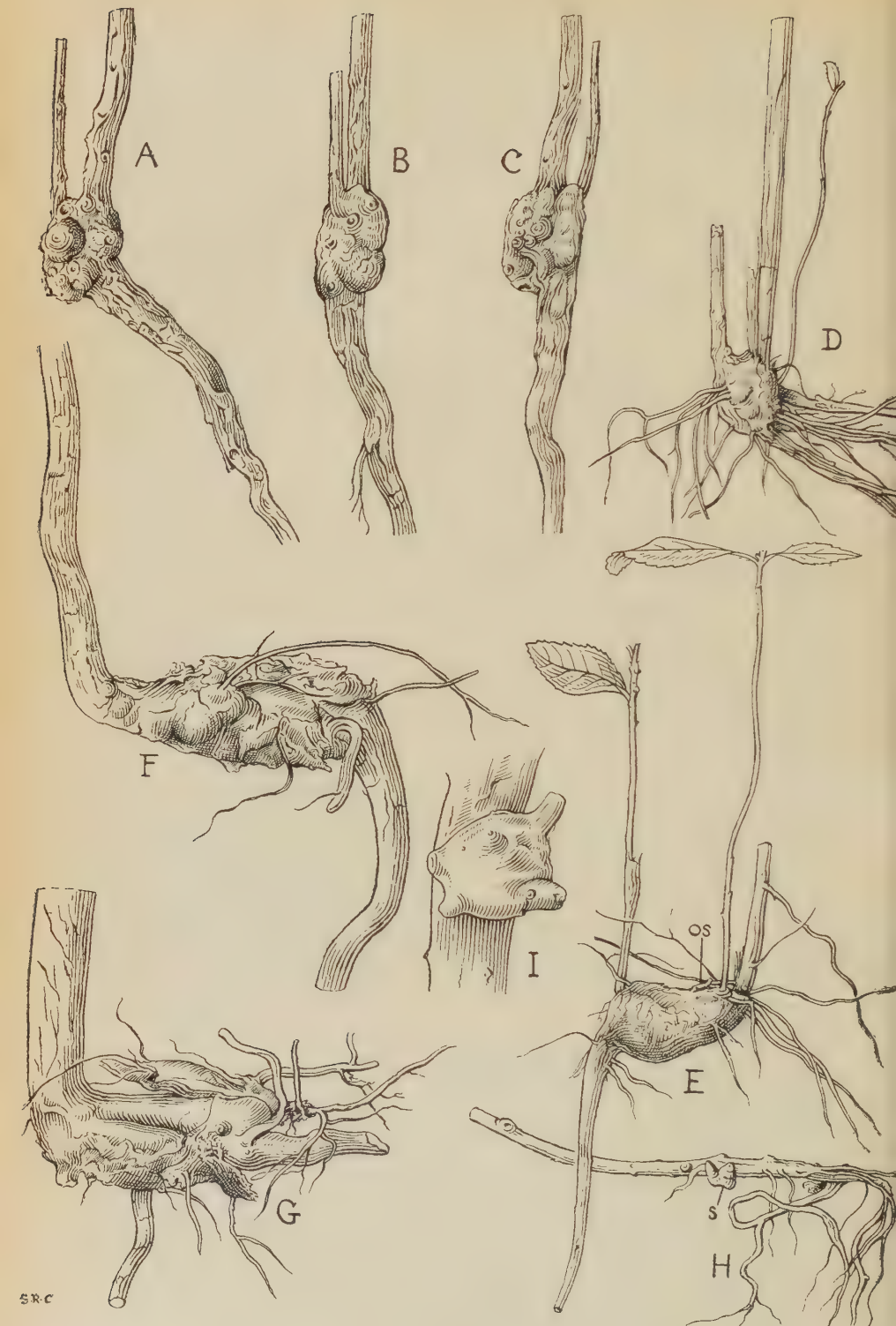

Fig. 1.

THE SWOLLEN STEM-BASE IN ARBUTUS UNEDO

J. Robert Sealy

During visits to Killarney in 1935 and 1938 a number of young plants of *Arbutus unedo* were collected. They ranged from tiny seedlings with cotyledons to plants 50–67 cm. high, and it was noticed that in all the larger specimens the lowermost part of the stem was swollen. The swollen part is well below ground level in living plants and cannot be seen until the plant is dug up. In the specimens collected the swollen part varied from irregularly subspheroid to ellipsoid, and from 1·5 cm. long and a little less in width to 4·5–5 cm. long and 2–2·5 cm. wide, the size increasing with the size of the plant ; the swelling was more or less unilateral, hard, woody, and had numerous small protuberances over the surface (Fig. 1). Certain smaller specimens were also found to have a swelling in the form of a small roundish somewhat flattened unilateral outgrowth, which was 5–6 mm. across, hard, woody, and with protuberances like those of the larger specimens (Fig. 1, H & I). Sectioning some of these swollen stems showed that they were composed of proliferated woody tissues developed excentrically or wholly unilaterally in relation to the original regular stele, and that within the proliferated tissues were vascular steles leading to the protuberances, which were adventitious buds. Small rounded bodies, whose structure and chemical reactions showed them to be aleurone grains were abundant in the proliferated tissues, as in the root, but were absent from the stem above the swollen part. There was no sign of bacterial or fungal infection, nor any evidence of mechanical injury. The fact that the swollen region was present in all the young plants and that it was in much the same position in each specimen, suggested that it might be a normal feature of the species, and this has been proved correct by its appearance in all plants grown at Kew that have been examined. Examples are shown in plates 1 and 2.

The development of this feature has been studied, and the results are set out below.

Two-year-old Plants.

Normally the cotyledons fall during the first year* and it might be expected that their scars would have been sealed off by the time another twelve months had passed. Examination of 32 two-year-old plants grown at Kew, showed, however, that the scars of the cotyledons, and also that of the first leaf, were still open, or very imperfectly covered by disorganised and apparently suberised tissues. In none of the specimens

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Fig. 1. The swollen stem-base in young plants of *Arbutus unedo* from Killarney. **A–C,** three views of the base of a plant 20·5 cm. high ; **D,** from a plant whose original stem (on left) was broken and had been replaced by a new shoot (centre) 22 cm. high, which, like the weak shoot (right), has arisen from the swollen region ; **E,** from a plant whose original stem (os) has died off, the present main stem (on right), which has itself been damaged and is just over 10 cm. high, and the two weak shoots have all arisen from the swollen region ; **F** & **G,** from plants respectively 50 cm. and 67 cm. high ; **H,** base of a five-year-old plant with a small swelling (s) ; **I,** swelling from H, × 4 ; all the other figures two-thirds natural size.

*Exceptions were plants grown in very poor conditions and which were only 2-4 cm. high at the end of their first year; these retained their cotyledons into the second year.

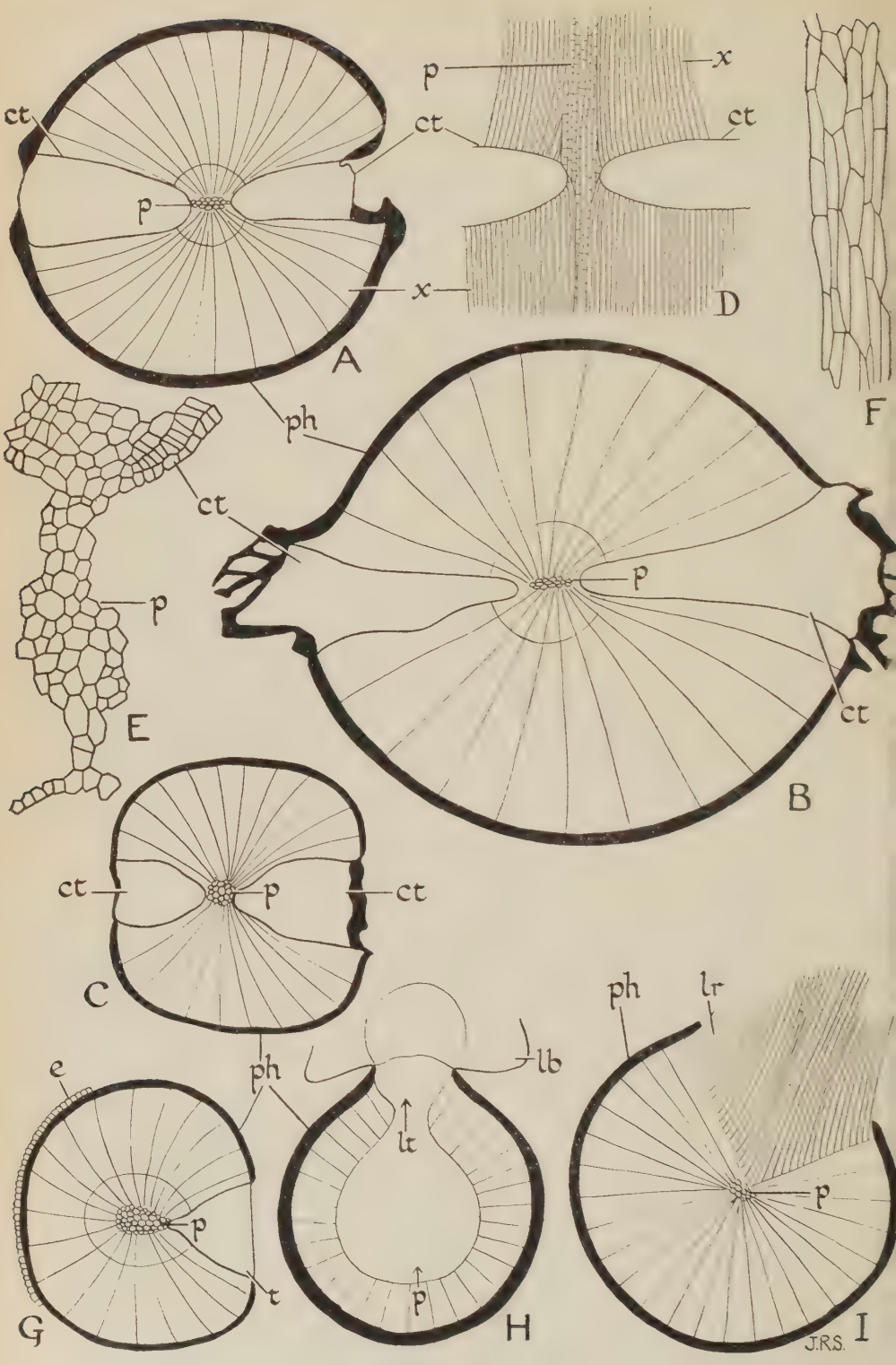
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FIG. 2.

were the scars enclosed by the secondary phloem and cork like the rest of the stem, and though in some plants the secondary tissues appeared to extend over the scars, they were always ruptured—apparently by the growth of the trace. In some instances the end of the trace was depressed below the surface of the bark (Fig. 2, A), but more often it projected, the projecting part consisting mainly of disorganised and partially suberised tissues (Fig. 2, B). Incidentally this did not form part of the normal bark, for the latter could be peeled away leaving the projections behind. The cotyledon-traces are relatively large ; they are somewhat conical with the base at the surface of the stem and the blunt apex at the pith, the latter being elongated between the two traces (Fig. 2, A, B, E). The traces pass through the stem horizontally, and consist of oblong or more or less cigar-shaped cells which fit together without intercellular spaces (Fig. 2, F). The stems varied considerably in size, the diameter, without the bark, ranging from 1 mm. to 4 mm. In smaller stems the trace-cells were mostly oblong, but in larger stems they were mostly elongated. The increase in length of the traces was clearly due to the elongation of its cells. This had been sufficient, even in the largest stems, to maintain the length of the trace equal to the radius of the stem.

The trace to the first leaf is similar to those of the cotyledons in structure and in passing through the stem horizontally (Fig. 2, G).

Traces of the other leaves, however, are quite different, for they consist of protoxylem arising at a steep angle to the pith and passing through a well-marked leaf-gap (Fig. 2, H). Nor do the traces to the cotyledons and first leaf bear any resemblance to lateral roots (Fig. 2, I).

Four-year-old Plants.

None of the two-year-old plants showed any sign of the development of buds or of proliferation, but both were present in a four-year-old plant grown at Kew. This had a small swelling on one of the cotyledon scars, and a similar swelling in the scar of the first leaf. Sections through the stem and cotyledonary outgrowth revealed a bud surrounded by proliferated tissues at the end of one cotyledon-trace, and the beginnings of another bud at the end of the other cotyledon-trace. It was also evident that the growth of the stem had become excentric (Fig. 3, A–G).

The buds had arisen during the third year ; one had continued to develop during the fourth year, but the other had not. The growth of the buds would come to a standstill when the plant passed into a dormant state at the end of the third growing season, and would, normally, be resumed the following spring. This had happened with respect to one bud, but the meristem of the other had given rise during the fourth season to secondary xylem instead of bud tissues, so that the incipient bud formed during the third season had become sealed off. Thus, by a most

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Fig. 2. Two-year-old plants of *Arbutus unedo*. **A–C**, transverse sections through the cotyledon-traces of three different plants, **A** × 30, **B** × 20, **C** × 40 ; **D**, longitudinal section through the cotyledon-traces, × 25 ; **E**, pith and base of one cotyledon-trace ; **F**, cells from a cotyledon-trace ; **G**, transverse section through the trace of the first leaf ; **H**, transverse section through stem and leaf-base, × 25 ; **I**, transverse section of root and branch, × 30 ; ct—cotyledon-trace, e—endodermis, lb—leaf-base, lr—lateral root, lt—leaf-gap, p—pith, ph—phloem, t—trace of first leaf, x—secondary xylem.

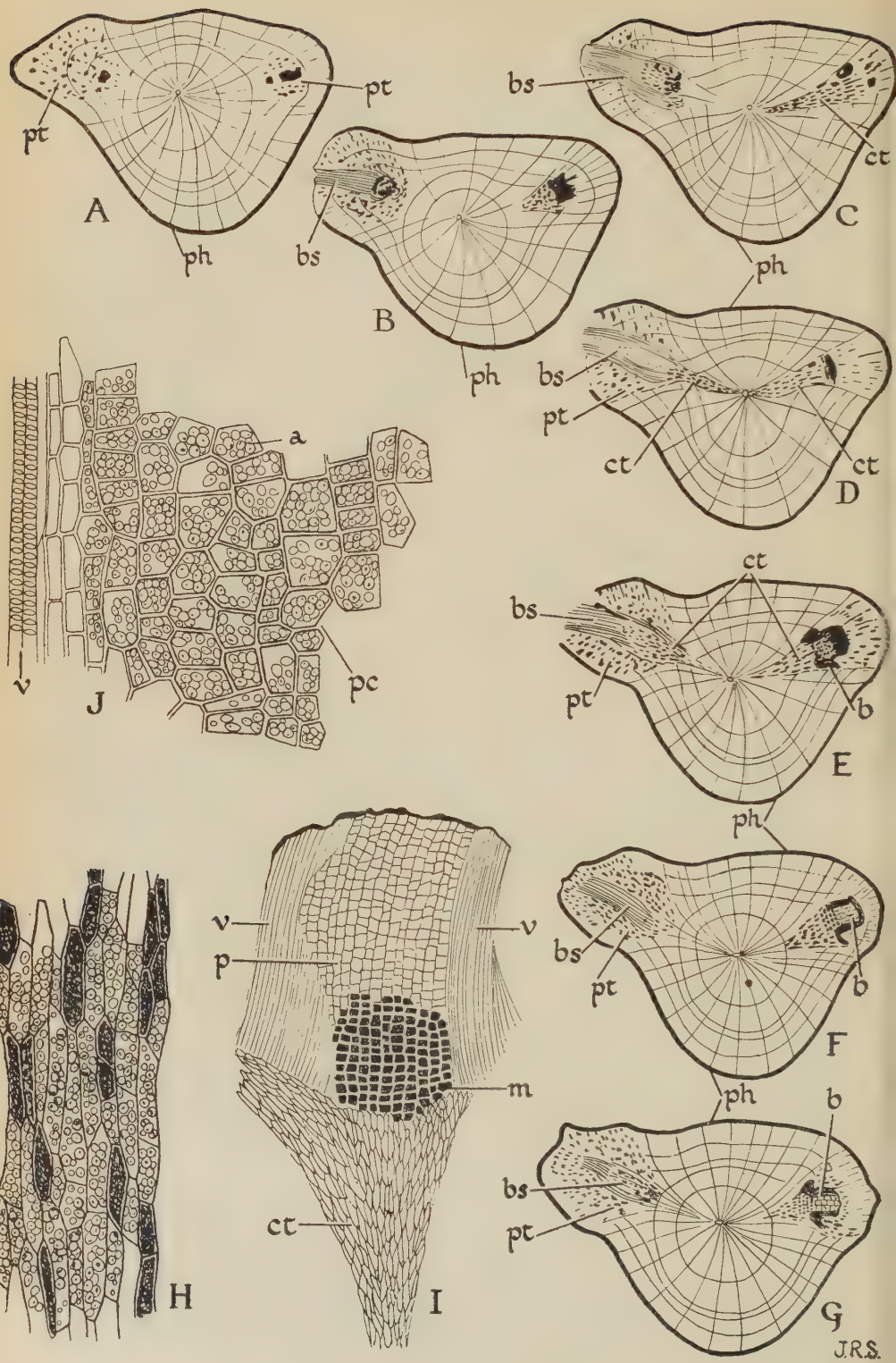
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FIG. 3.

fortunate chance, the one stem showed a bud of one year's growth and also a bud two years old (Fig. 3, A–G).

As in the two-year-old plants described above, the cotyledon-traces were formed of narrow cells, pointed at both ends, and fitting together without intercellular spaces ; these cells were filled with aleurone grains (Fig. 3, H). Evidently during the third season's growth a meristem arose at the distal end of each trace. At the end of the third year part of the meristematic tissue was present in the form of a compact block of cells which stained very deeply, while extending from it towards the periphery of the stem was the bud-stele formed by the meristem (Fig. 3, F, G, I). The bud-stele consisted of a relatively broad pith enclosed in a sheath of annular vessels ; the pith-cells fitted together without intercellular spaces and were filled with aleurone grains (Fig. 3, J). The extent of development of the bud during its first year's growth is shown in Fig. 3, E–G, (b) ; around the bud-stele the tissues were proliferated to a slight extent, and it may be noted that the secondary xylem which replaced the bud-stele the following year was also somewhat irregular. The condition of the bud at the end of its second season is shown in Fig. 3, B–G (bs) ; it will be seen the bud-stele is elongated and that the tissues around it have become so much proliferated that they form a distinct swelling. It will also be evident that the growth of the stem itself had become excentric in such a way that the two buds and their attendant proliferated tissues were to one side, while the greatest development of the normal stem tissues was to the opposite side. As already mentioned, there was also a bud at the end of the trace of the first leaf ; this was similar to the fully developed cotyledonary bud.

Though cotyledons do not usually subtend buds, they may do so in some plants (e.g. *Vicia faba* L.), and buds can often be induced to develop by injury to the plumule. The association of a bud with the cotyledons and first leaf in *Arbutus unedo* could therefore be regarded as a normal phenomenon, and comparable with the bud which arises in the axil of an ordinary foliage leaf. The fact that the bud-primordia now under consideration arise from the cotyledon- or leaf-trace, instead of from the stem-tissues immediately above it, could be accepted as due to the peculiar structure of these traces as compared with normal leaf-traces. The origin of the buds in connexion with the cotyledons and first leaf, could therefore be ascribed to the stimulus which causes buds to arise in the axils of foliage leaves. This would leave one phenomenon to be explained, namely, why the development of the cotyledon and first leaf buds should be accompanied by proliferation of the surrounding tissues when ordinary leaf-buds are not. The explanation is perhaps to be found in the fact that, as explained below, the cotyledons and first leaf are situated in a part of the plant where, as in the root below it, food-reserves in the form of aleurone grains are very common, whereas these reserves

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Fig. 3. Four-year-old plant of *Arbutus unedo*. **A–G**, serial transverse sections through the swollen region, **A** from the cauline end, **G** towards the radicle end, × 4 ; **H**, cells from the cotyledon-trace ; **I**, arrested bud ; **J**, pith-cells and vessels from the bud-stele ; a—aleurone grains, b—arrested bud, bs—bud-stele, ct—cotyledon-trace, m—meristematic cells, p—pith of bud-stele, pc—pith-cells, ph—phloem, pt—proliferated tissues, v—vessels.

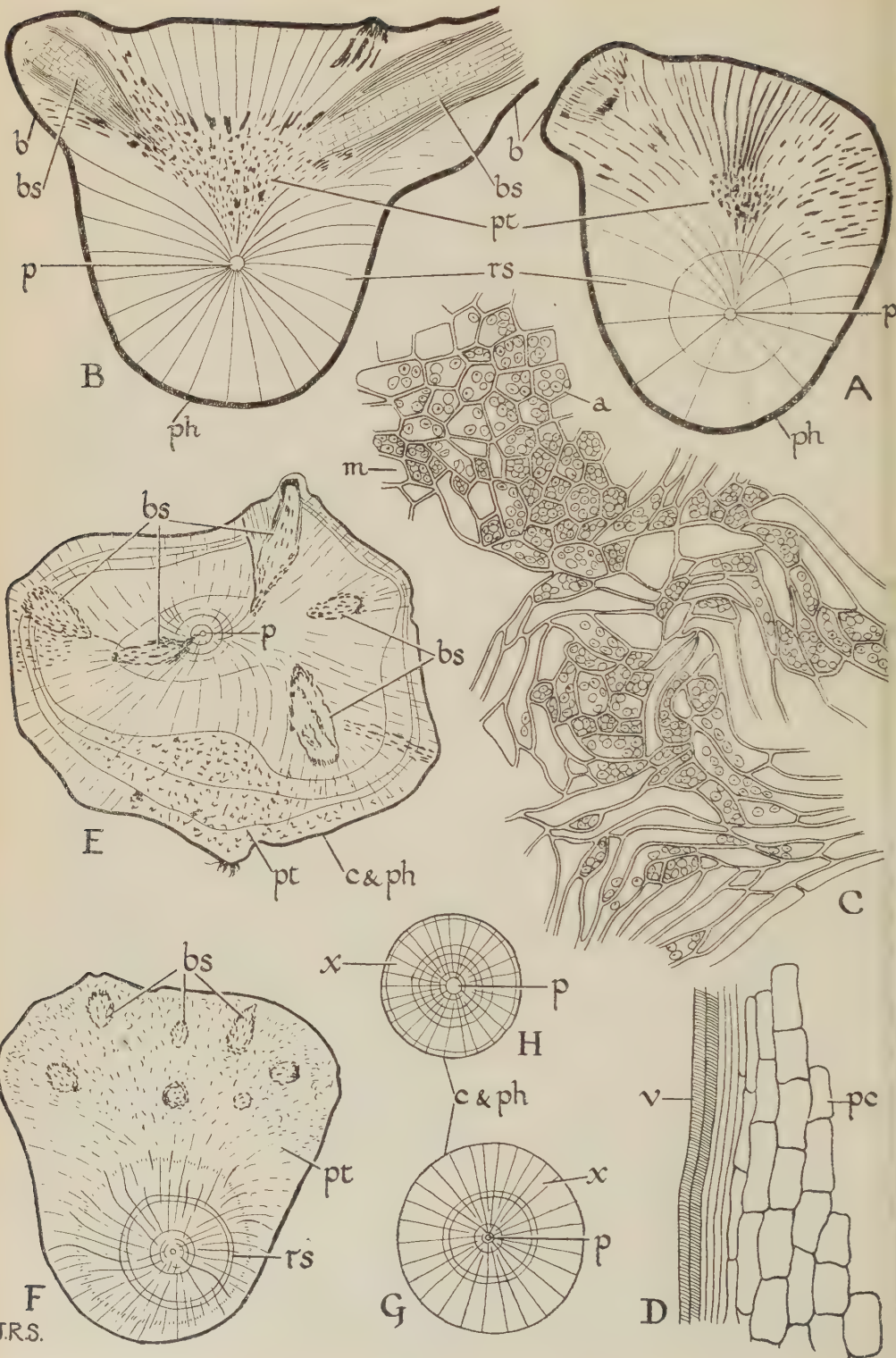
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Fig. 4.

are not present higher up the stem. Meristems arising in a region of plentiful food-reserves might well develop exuberantly, so that the tissues formed are both excessive in amount and irregular in orientation—proliferated in fact—whereas meristems some distance from the food-reserves behave in a more rational manner and produce tissues normal in extent and in arrangement.

Five-year-old Plants.

Two seedling plants collected in the Killarney area had each a small unilateral swelling in the lower part of the stem. In both the swelling was roundish, somewhat flattened, 5–6 mm. in diameter, and had small protuberances (buds) at the surface (Fig. 1, H, I). It proved to consist of a number of buds and their steles together with proliferated tissues, the whole developed unilaterally in relation to the regular part of the stem (Fig. 4, A, B). The plant proved to be five years old, and the swollen part was clearly a further development of the condition described above for four-year-old plants, the tissues associated with the buds being more extensive and even more disorganised. In particular the meristematic zone towards the pith of the stem, that is the part left after the development of the first bud, had given rise to particularly disorganised tissues with many of the cells filled with aleurone grains (Fig. 4, C). The cells of the meristematic zone were also filled with aleurone grains, as were the medullary ray cells in the regular xylem adjacent to the zone, while many of the vessels also contained this food-reserve. This is the condition found in the root, where aleurone grains usually fill the cells of the medullary rays and are commonly present in the vessels and in the cells of the pith. In the stem just above the swollen region aleurone grains were present in the pith-cells but nowhere else, while higher up the stem they were not observed at all.

Older Plants.

In Fig. 4, E and F show transverse sections through the swollen part (about 2·5 cm. long and 1·5 cm. in diameter in the widest part) of a plant about seven years old. Figure E from near the middle of the swollen region shows how the proliferated tissues have extended all round the original stele and that they include several bud-steles. Towards the radical end of the swollen region (Fig. 4, F) the proliferated tissues and bud-steles are unilateral in relation to the original stele of the plant, which is here not very different from the root 1 cm. below the swollen part (Fig. 4, G). The structure of the stem 4 cm. above the swollen part is shown in Fig. 4, H.

The first bud to be developed in what is by now quite an extensive swelling, appears to have arisen during the third year's growth. The

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Fig. 4. **A–D** from a five-year-old plant of *Arbutus unedo*; **A** & **B**, transverse sections of the swollen region, × 12, **A** towards the cauline end, **B** towards the middle; **C**, meristematic cells and proliferated tissue; **D**, part of a bud-stele. **E–H** from a plant of *Arbutus unedo* about seven-years old; **E** & **F**, transverse sections of the swollen region, **E** from near the middle, **F** towards the radicle end, both × 4; **G**, transverse section of the root 1 cm. below the swollen region, × 4; **H**, transverse section of the stem 4 cm. above the swollen region, × 4; b—bud, bs—bud-stele, c—cork, m—meristematic cells, p—pith, pc—pith-cells, ph—phloem, pt—proliferated tissues, rs—regular stem-tissues, v—vessels, x—secondary xylem.

anatomical details of the various parts of the swollen region are exactly as described above for younger plants. In the middle of the swollen region the xylem tends to be arranged regularly except in the vicinity of the bud-steles, where, as in the peripheral part of the stem, the tissues are completely proliferated, appearing in transverse section as a haphazard arrangement of xylem elements cut in various directions. The phloem too is much compressed and disorganised in places. There is an endodermis of a single layer of fairly large cells, outside which is the suberised tissue of the bark. In the more radical section (Fig. F) the phloem and endodermis are recognisable in the region of the regular part of the stem, but they are compressed out of all recognition around the proliferated part. Aleurone grains are common in all the tissues of the radical part of the swollen region, but higher up they were absent from the regular tissues, though common in the proliferated tissues.

The rapid growth of the proliferated part of the stem is particularly noticeable. Its actual size at any particular age evidently depends on the size and vigour of the plant, which in turn reflects the conditions under which it has grown. The following observations, made on plants grown at Kew which represented vigorous examples at the various ages grown under similar conditions and therefore more or less comparable, probably gives a fair picture of the growth made under good conditions.

Age of plant	Height of plant	Diameter of stem in widest part	Size and condition of the swollen region
2 years	30 cm.	4 mm.	not developed, no sign of buds or of proliferation
4 years	55 cm.	8 mm.	scarcely discernible, bud present in traces of cotyledons and first leaf, proliferation well marked
9 years	135 cm.	2·2 cm. × 2·7 cm.	4 cm. long and 6 cm. wide, surface crowded with buds, and tissues greatly proliferated
9 years	180 cm.	3 cm. × 4 cm.	6 cm. long and 7 cm. wide, otherwise as previous example
10 years	200 cm.	Stem forked at base, one branch 2·8 cm. × 3 cm.; the other 3 cm. × 4 cm.	7·5 cm. long and 10·5 cm. wide, buds crowded over the surface, tissues greatly proliferated, some buds grown out into shoots.

Plate 1.

The swollen stem-base of a ten-year-old plant of *Arbutus unedo* grown at Kew from seed received from Killarney in 1937, the shrub 200 cm. high and the swollen part 7·5 cm. long and 10·5 cm. wide; two-thirds natural size.

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Plate 2.

A **B**

The swollen stem-base of nine-year-old plants of *Arbutus unedo* grown at Kew from seeds received from Killarney in October 1937. **A** from a shrub 135 cm. high with the swollen part 4 cm. long and 6 cm. wide. **B** from a shrub 180 cm. high with the swollen part 6 cm. long and 7 cm. wide, both one-half natural size.

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Comparison with Similar Structures in Other Plants.

As already indicated, the occurrence of the swollen stem-base in *Arbutus unedo* appears to be a normal feature of the species. It was noticed in young plants of the species from the Piñada of Arcachon (S.W. France) by Dufrenoy (1922), but was not described in detail by him.

Its presence seems to be advantageous in two ways. First it helps to anchor the plants in the clefts and fissures of rocks which are so often the habitat—even small plants prove troublesome to extricate—and secondly it provides a " reservoir " of buds from which new shoots can be developed should the primary stem become damaged—examples of this are shown in Fig. 1, D and E. A third possible function is that it may act as a food-storage organ, for, as mentioned above, aleurone grains are plentiful in the tissues of the swollen part as they are in the root.

The occurrence of a swollen stem-base has been reported, but not described in detail, for *Arbutus menziesii* Pursh (Jepson, 1939), and a similar structure has been recorded for other genera, including *Arctostaphylos* (Jepson 1916 and 1939; Wieslander & Schreiber, 1939) which is nearly related to *Arbutus*. In *Arbutus menziesii*, *Arctostaphylos* species, and *Adenostoma fasciculatum*, emphasis has been laid on the value of the swollen stem-base in regeneration after fire (Jepson, 1916, 1936, 1939). The plants all belong to the Californian plant-communities known as " chaparall ", which are the equivalent of the Mediterranean " macchie" in which *Arbutus unedo* often plays a prominent part, being evergreen shrub-communities developed under similar climatic conditions. It is therefore probable that the swollen stem-base has a similar biological significance in all the plants in which it occurs, and that it is related to the habitat, though not necessarily to the incidence of fire. Attention was first drawn to the swollen stem-base in *Arctostaphylos* by Jepson (1916), who found that those American species which sprouted from the base after being burnt, had heavy " root-crowns", while those species which were killed by fire lacked these structures. Wieslander and Schreiber (1939) showed that the " root-crown " was a normal feature which appeared early in the life of the seedling as a few nodules, developed steadily with age, and ultimately attained a diameter of a foot or more. They say that the outer surface of the structure is simply an aggregation of buds, which sprout when the plant is injured, but they give no details of the origin of the organ nor of its anatomical structure.

Dufrenoy (1922) drew attention to the resemblance between the swollen stem-base of *Arbutus unedo* and a similar structure in *Eucalyptus*. The latter has been investigated in detail by Kerr (1925) and by Carter (1929), and found to be a normal feature in the growth of the plant ; it is not the result of infection or parasitism, and cannot be produced by artificial stimuli. It starts as swellings in the axils of the cotyledons, these swellings being outgrowths of proliferated tissues which arise from the cambium and increase in size until they meet and encircle the stem. This may be followed by the formation of swellings in the axils of one or more pairs of leaves immediately above the cotyledons ; each pair of swellings fuses and then all the pairs grow together to form one large nodule. In some species of *Eucalyptus* the swellings appear when the seedling is 9–12 weeks old ; in other species the plants may be 14–30 weeks old before there is any sign of proliferation. For the most part

the swollen region consists of a large number of curiously interwoven thick-walled tracheae, with medullary rays between them and with vessels and wood-fibres developed at irregular intervals. Mostly the arrangement of the tissues is quite haphazard. Both tracheae and medullary rays are filled with food-reserves (starch and aleurone grains), and a large number of adventitious buds is produced. The swollen stem-base in *Eucalyptus* apparently enables the seedling to tide over periods of drought, and from it new shoots arise if the stem be damaged or destroyed. Not all the species of the genus have the structure, and in general it is best developed in species inhabitating regions most liable to drought. It is said that seedlings can persist through a long hot summer in a few inches of soil over rock, and may even survive two or three unfavourable periods, despite the shoots being killed—new growths being produced from the swollen part until the food-reserves are exhausted.

The proliferated region in *Eucalyptus* evidently differs greatly from that in *Arbutus* in its origin and anatomy, and in the much earlier stage at which it arises. There is, however, marked similarity in the position of the structure, in its proliferated nature, in the fact that it contains food-reserves of a similar kind, and in the production of adventitious buds.

In Australia, as in California, a number of plants are known to regenerate after fire by the production of shoots from swollen (underground) stem-bases (Beadle, 1940), but details of the origin and structure of the swollen region in the various plants have not been given. A figure of the organ in *Banksia serrata*, however, suggests that it is much like that of *Arbutus* in position and external appearance.

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TWO NEW SPOROBOLI FROM SOUTHEAST ASIA.

N. L. Bor.

Sporobolus tetragonus *Bor*, sp. nov. *S. capillari* Miq. similis sed ab ea caryopse majore, elliptica, 4-gona haud plana orbiculareque, spiculae partibus majoribus valde recedit.

Gramen annuum. *Culmi* usque 55 cm. alti, infra inflorescentiam laeves glabrique. *Foliorum laminae* lineari-lanceolatae, usque 15 cm. longae, 9 mm. latae, planae, flaccidae, supra scabrae, infra laeves, utrinque glabrae, marginibus apicem versus scabrae, basin versus marginibus pilis e tuberculis ortis instructae ; laminae superiores plicatae, erectae ; *foliorum vaginae* superne longae, complectentes, inferne laxae, breviores, laeves glabraeque ; ligula ad labrum dense ciliatum redacta.

Panicula effusa, usque 25 cm. longa, 8 cm. lata, saepe brevior angustiorque, elliptica ; rami ad 5 cm. longi, verticillati, graciles, laeves glabrique vel minutissime scaberuli, ramosi, paucas spiculas gerentes ; pedicelli scabri. *Spiculae* 1·75 mm. longae, elliptico-acutae. *Gluma inferior* 1 mm. longa, lanceolata, acuta, enervis, marginibus et dorso apicem versus scabra. *Gluma superior* 1·75 mm. longa, elliptico-acuta, 1-nervis, hyalino-cana, carina et dorso apicem versus scabra ; *lemma* 1·75 mm. longum, lanceolatum, obtusum, laeve glabrumque enerve ; *palea* 1–1·5 mm. longa explanata late elliptica nervis duobus contiguis ; *stamina* tria ; *caryopsis* 1 mm. longa, elliptica, acute 4-angulata.

Siam. Kanburi *A. F. G. Kerr*, 19762 (Typus : Herb. Kew).

Burma. Without locality, 1940, *U. Thein Lwin*, 205.

India. Bihar and Central Provinces (identified as *S. pulchellus* R. Br. in Flor. Brit. Ind. **7,** 252 : 1896).

A very variable species. The specimens from Burma and Siam are very robust while those from India vary from very slender and weak to fairly robust. There is very little difference in spikelet measurement and none in the grain between specimens from the three localities. The Indian specimens had all along been considered identical with *S. pulchellus* R. Br., an Australian species of which there are sheets at Kew from Port Darwin and the north coast of New Holland, including the type. The grain of *S. pulchellus* R. Br. is obovate or elliptic-obovate, rounded or almost flat on the top, 4-angled. The leaves are very narrow while the grain is almost square in cross section with rounded angles, and the latter is much shorter (0·7 mm. long) than the grain of *S. tetragonus*.

Sporobolus kerrii *Bor*, sp. nov., ab omnibus speciebus ex Asia descriptis, spiculis rubris magnis (4·5 mm. longis) distinguitur.

Gramen perenne. *Culmi* crassi usculi usque 60 cm. alti, foliorum vaginis paene ad inflorescentiam tecti, laeves, glabri. *Foliorum laminae* usque 25 cm. longae, 7 mm. latae, lineares, in apicem acutum sensim attenuatae, basin versus angustiores rigidulae, planae vel plicatae, infra glabrae, supra glabrae sed basi pilis longis albis e tuberculis ortis instructae, marginibus pilis longis albis e tuberculis ortis ciliatae ; *foliorum vaginae* basi imbricatae, superne longiores, laeves glabraeque, marginibus pilis longis ciliatae, laxiusculae ; *ligula* angustissima, membranacea.

Panicula laxa, usque 20 cm. longa, 6–7 cm. lata ; rami verticillati, patentes, flexuosi, laeves vel scabri, glandulosi, breviter ramosi, spiculis paucis breviter pedicellatis instructi. *Spiculae* rubrae, 3·5–4·5 mm. longae, maturitate hiantes. *Gluma inferior* 2–2·5 mm. longa, angusta, a latere visa acicularis, explanata lanceolato-acuminata, 1-nervis, laevis glabraque. *Gluma superior* 3·5–4·5 mm. longa, 3-nervis, lanceolata, acuta, laevis glabraque. *Lemma* 3–4 mm. longum, lanceolatum, acutum, laeve glabrumque, apice scabrum, 3-nerve ; *palea* 2·5–3·5 mm. longa, elliptica, acuta, nervis duobus medianis, intra nervos tenuissima et a caryopsi crescente demum fissa. *Caryopsis* ambitu obovata, 1·5 mm. longa, transverse secta lenticularis, embryone magna dimidia longitudine caryopseos ; pericarpio irregulariter canaliculato, madefacto tumefacto unilateraliter fisso et semen ejiciente.

Siam. Kao Kinading, Loi, 11 Feb. 1931, *A. F. G. Kerr* 20069. Typus in Herb. Kew.

Varietal names in Cytisus absinthioides:—Examination of material of *Cytisus absinthioides* Janka and *C. rhodopeus* Wagner ex Degen in the Kew Herbarium and of specimens of these two species received on loan from the Herbarium of the Agronomical Faculty of the University of Sofia, shows that *C. rhodopeus* is conspecific with *C. absinthioides*. It therefore becomes necessary to transfer certain varieties of *C. rhodopeus* to *C. absinthioides* as follows :

C. absinthioides *Janka* var. grandiflorus (*Stoj.*) comb. nov. (*C. rhodopeus* Wagner var. *grandiflorus* Stoj. in Bull. Soc. Bot. Bulg, 5, 105 (1932)).

C. absinthioides *Janka* var. pirinicus (*Stoj.*) comb. nov. (*C. rhodopeus* var. *pirinicus* Stoj. l.c.).

C. absinthioides *Janka* var. austriacoides (*Stoj.*) comb. nov. (*C. rhodopeus* var. *austriacoides* Stoj. l.c.).

C. absinthioides *Janka* var. parviflorus (*Stoj.*) comb. nov. (*C. rhodopeus* var. *parviflorus* Stoj. l.c.).

R. A. Blakelock.

CONTRIBUTIONS TO THE FLORA OF TROPICAL AMERICA : XLIX.*

Notes on Rubiaceae.

N. Y. Sandwith

Teinosolen, Lecanosperma and **Heterophyllaea.** *Teinosolen* was described as a new genus by Sir Joseph Hooker in the account of *Rubiaceae* in the *Genera Plantarum*, **2,** pars 1, 61 (April 1873), being placed next to *Mallostoma* (now *Arcytophyllum*) in the tribe *Hedyotideae*. The description was complete except for that of the seeds, which had evidently not been seen. The genus was said to consist of 3 or 4 species, natives of the Andes of Bolivia, but no individual species was named. In the first issue of *Index Kewensis*, **2,** fasc. 4, p. 1041 (1895), Jackson listed three binomials under *Teinosolen*, viz. *T. grandiflora*, *T. macrosepala* and *T. pearcei*, all accredited to "Hook. f. in Herb. Kew." and therefore *nomina nuda*. Four years earlier, K. Schumann had contributed the account of *Rubiaceae* for the *Pflanzenfamilien*, retaining *Teinosolen* in its position next to *Arcytophyllum*, from which he distinguished it by the shape of the corolla : the two genera were placed in his group *Cinchonoideae-Cinchoninae-Oldenlandieae*, with wingless seeds (vol. **4,** 4, pp. 23, 27). Schumann assigned to *Teinosolen* 3–4 species from the Andes of Bolivia and Quito, mentioning only one, by name alone, viz. *T. jamesonii* K. Schum., of which he gave a habit figure (Fig. 8, J) showing the top of a leafy shoot with two flowers. Schumann's generic description is practically a transcription in German of Hooker's Latin : Hooker had not been dealing with Quito material, and accordingly, since no analysis accompanies the figure of the Quito *T. jamesonii*, while the androecium and gynoecium are concealed by the corolla, this binomial should also be treated as a *nomen nudum*, *Teinosolen* thus remaining without a specific type. Earlier still, Baillon (*Hist. Pl.* **7,** 326 (1880)), had merged *Teinosolen* along with other genera in *Oldenlandia*, but added nothing to Hooker's description except that he described the terminal flowers as "peu nombreuses ou solitaires." No further information was given by Post, rev. Kze., *Lexicon*, 562 (1903), where the spelling was altered to *Tinosolen*, or by Lemée, *Dict. Phan.* **6,** 474 (1935). Finally, Standley, in his papers on the *Rubiaceae* of Ecuador and Bolivia (*Field Mus. Publ., Bot. Ser.* **7,** 209 and 282 (1931)), maintains *Teinosolen* as an unnumbered genus without any formally described species, evidently unknown to him and, in his opinion, very close to *Arcytophyllum* and probably to be reduced to it.

Meanwhile Rusby had described and figured a new monotypic genus *Lecanosperma*, from Bolivia, see *Bull. Torr. Bot. Cl.*, **20,** 430–431, pl. clxviii (1893). This was placed by its author in the *Cinchoneae* (a group with winged seeds), between *Bouvardia* and the little-known genus *Heterophyllaea* Hook. f. The species, *L. lycioides* Rusby, has since been recollected in Bolivia, see Standley l.c. 266, and in Peru, see Standley in Macbride, *Fl. Peru*, part **6,** 23 (1936). Standley has retained *Lecanosperma* in the *Cinchoneae* next to *Heterophyllaea*, but Kuntze had already gone further and reduced it to that genus, which he divided into two sections, *Euheterophyllaea* O.K. and *Lecanosperma* O.K., see Post, rev. Kze., *Lexicon*, 278 (1903).

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*Cont. from K. B. 1948, p. 322.

Heterophyllaea itself was described and figured as a monotypic genus from a specimen collected by Pearce in Jujuy, Northern Argentina, by Sir Joseph Hooker in the *Genera Plantarum*, l.c. 37 (April 1873). In the same month of the same year the description and figure of the monotype, *H. pustulata* Hook. f., appeared in Hooker's *Icones Plantarum*, t. 1134. At this date the fruit and seeds were unknown and the genus was placed by Hooker, with some little hesitation, near *Bouvardia* in the *Cinchoneae*. It has been retained in the latter group by Schumann and Standley, Schumann (l.c. 42, 49, Fig. 18, F, G) placing it in his group *Cinchonoideae–Cinchoninae–Cinchoneae*, with winged seeds, between *Bouvardia* and *Hindsia*. Grisebach, however, who saw a single seed from an old capsule, found it unwinged and therefore regarded the genus as occupying an anomalous position in the true *Cinchoneae*, connected in habit with the genus *Exostemma*, see *Goett. Abh.* **24,** 154 (1879). At this time Grisebach was describing a new species, *H. lanceolata*, from Salta in Northern Argentina. Baillon (l.c. 461), as will be repeated later in this note, reduced *Heterophyllaea* to *Bouvardia*. More recently, the Bolivian species *Hindsia fiebrigii* Krause was transferred to this genus by Standley, see *Field Mus. Publ., Bot. Ser.* **11,** 214 (1936), while Schumann had mentioned a second undescribed species (presumably from Bolivia) which he had found in herbaria, to which he gave the *nomen nudum*, *H. mandonii* K. Schum. The genus is remarkable for the pustules found on the branchlets, leaves, calyx and corolla limb, and for the crenate leaves of the type species, with pustules in the sinuses.

We must now consider the identity of *Teinosolen*, since the evidence is in the Kew Herbarium alone and has apparently not been examined since Hooker worked with it. Three of the four sheets in the cover bore specimens which correspond to the three binomials given in *Index Kewensis*. The name and analytical drawings in Hooker's hand are on each sheet, but Hooker had omitted to correct his original reference of the plants to the genus *Mallostoma*. The three collections are therefore as follows : *M. grandiflora*, Bolivia, *Bridges* 18, ann. 1846 ; *M. macrosepala*, Peru, *Lobb* 338 ; and *M. pearcei*, South America (without further details), *R. Pearce*, purchased Sept. 1868. The obvious resemblance of these specimens to *Lecanosperma lycioides*, represented at Kew by the type collection (*Bang* 1122) and by an unnumbered specimen of Bridges from Bentham's herbarium (identified by Standley), was suggested to the writer during the War when he was placing types of *Rubiaceae* in special covers for the purpose of removal to safety. This resemblance now proves to be generic identity, when the descriptions and specimens of the two genera are closely examined, and Hooker's drawings compared with Rusby's plate which was made from a drawing prepared by Miss M. Smith. The villous zone on the inner side of the corolla tube at the insertion of the stamens is not shown in Rusby's plate, as it is in one of Hooker's sketches, but it is mentioned in the generic description of *Lecanosperma*. Again, the filaments are said to be wanting in *Lecanosperma*, short in *Teinosolen*. They are certainly not shown in Rusby's plate beneath the dorsifixed anthers and their absence, as well as variation in the indumentum of the corolla tube, is explained by the sexual dimorphism of the flowers of the plants we are discussing. The long-styled corollas have a campanulate upper portion of the tube near the base of which the anthers

are subsessile in a broad villous zone ; whereas short-styled flowers have a more gradually attenuate tube which is nearly glabrous within (zoneless, irregularly pubescent in a longitudinal line in the lower third), and the shorter anthers are exserted at the throat, with distinct filaments inserted a short distance below the mouth. Thus the stamens of the short-styled flower of the Bridges specimen of *Lecanosperma* have filaments 1–1·5 mm. long. The capsule of *Lecanosperma* was described as " imperfectly loculicidal, the septum delicate, early separating from the walls to simulate a one-celled capsule," whereas that of *Teinosolen* is " septicide 2-valvis", according to Hooker : this discrepancy will be discussed later on. The seeds of *Lecanosperma* were described as " rather numerous in the cells ", but few are figured, not more than the 6–8 mentioned by Hooker on one of the sheets of *Teinosolen*. Finally, the seeds of *Lecanosperma* were described by Rusby as saucershaped and winged, and by Standley as narrowly winged, whereas Hooker apparently saw no seeds of *Teinosolen*. The present writer has no hesitation in combining the two genera.

The Bridges specimen of *Lecanosperma lycioides* had been lying undetermined at Kew and was eventually identified by Standley. It agrees very well with *Bang* 1122, except that the corollas are of the short-styled type with exserted anthers. But a sister sheet of this collection, also from Herb. Benth., exactly matching it and labelled Bolivia, *Bridges* 17, ann, 1846, was the fourth sheet in the cover of *Teinosolen*. No name had been written by Hooker on either of these sheets, and no doubt it was these specimens, which seemed to differ from the three others in their very small leaves, which caused him to write " species 3 vel 4 " in the *Genera Plantarum*. We have now reached the point where we must ask, are the three mss. species of *Teinosolen* distinct, and what is their specific relationship to these Bridges specimens which agree with *Lecanosperma lycioides*? *T. pearcei* agrees with them in the floral parts but has a somewhat different appearance on account of the laxer, less gnarled growth, with longer shoots and internodes, and considerably longer leaves sometimes nearly reaching 1 cm. and 2·5 mm. wide. *T. macrosepala* has leaves a stage bigger, up to 1·2 cm. long and 3·5 mm. wide, while the floral parts again agree with those of *L. lycioides* except that some of the calyx lobes are as long as 4–5 mm. The present writer sees no taxonomic significance in this, since the lobes are variable in length on different calyces and even on the same calyx of this gathering, a phenomenon apparent on other sheets of the genus. Finally, in *T. grandiflora* we have a specimen with leaves like those of *T. macrosepala*, calyx lobes often 5 mm. long and 1·5 mm. wide, and a larger corolla, with the tube up to 2·8 cm. long, and the lobes about 7 mm. long and 3 mm. wide. This plant does look strikingly distinct on account of its corolla, with lobes quite twice as long as those of the flowers on the other sheets. Nevertheless, the present writer is inclined to believe that no more than normal variation within one species, such as one would expect to find in a shrub growing in different habitats and under different exposure, is represented by the four gatherings of *Teinosolen* and by *Lecanosperma*. This being so, the form of extreme exposure, with very small leaves which, nevertheless, show a range of variability in size proportionate to that of the other forms, is the only one which has been validly described as a species, *Lecanosperma lycioides*, and

the epithet of that name must therefore cover all these plants unless it can be satisfactorily demonstrated that they include more than one species.

Having united *Lecanosperma* with *Teinosolen*, we must now consider whether Kuntze was not justified in reducing the genus to an undefined section *Lecanosperma* of the related *Heterophyllaea*. In *Heterophyllaea* all parts, especially the leaves, are on a bigger scale, but the name itself implies the presence of smaller leaves on axillary short shoots, which is a characteristic feature of *Teinosolen*. The inflorescence consists of a terminal corymb of alternate 1-flowered cymes (not of axillary cymes, as stated by Hooker in the *Icones*, although he described the corymbs as terminal in the *Genera Plantarum*), while the ovules are described as very numerous. Otherwise, the technical characters, including the swollen placentae, seem to be the same as those of *Lecanosperma* and *Teinosolen*. And it is significant that the remarkable pustules, which are so characteristic of *Heterophyllaea*, are to be seen on the corresponding parts of specimens of the other genus and are particularly obvious on *Bridges* 18 (*Teinosolen grandiflora*). The crenate leaf-margin of *H. pustulata* must now be discounted as a character of real generic importance, since the large leaves of *H. fiebrigii*, in spite of the pustules, are not evidently wavy-crenate to anything like the same degree (in spite of Standley's remark, loc. cit.), and the very reduced leaves of *Teinosolen* would not be likely to exhibit this feature and, in fact, do not do so. Conspicuously wavy-crenate leaves may perhaps be regarded as a specific character of *H. pustulata*, since they are present on a recent collection (*Venturi* 8304) of this species, again from the Argentine province of Jujuy, which agrees perfectly with Hooker's type. As for the species of Salta, *H. lanceolata* Gr., which also has crenate but much smaller leaves, the diagnostic characters italicised by Grisebach are simply those of a short-styled corolla with exserted anthers, whereas Hooker had described and figured a corolla with a long exserted style and included stamens. The rest of Grisebach's description fits *H. pustulata*, except that the measurements of the leaves are given as 1 inch in length and 2–3 lines in breadth. It is conceivable that *H. lanceolata*, which was said to be poisonous to cattle, is no more than a small-leaved form* of *H. pustulata*, while the Bolivian *H. fiebrigii*, described from a plant with long-styled corollas, may be only a hairy variety of the same species with much less wavy-crenate leaves. No material collected by Mandon which could be referred to *H. mandonii* K. Schum. has yet been traced in the Kew Herbarium. Since the species of *Teinosolen* (including *Lecanosperma*) merely represent a *Heterophyllaea* with more intricate branching, shorter internodes, reduced leaves, the inflorescence reduced to a single flower, and less numerous ovules, which has evolved at high altitudes on the Andes of Bolivia and Peru, where all these plants occur at about 2000–2800 m., there is surely a good case for uniting the two genera, and the present writer chooses to follow Kuntze, proposing the following combination for the small-leaved plant :

Heterophyllaea lycioides (*Rusby*) *Sandwith*, comb. nov.—*Lecanosperma lycioides* Rusby in Bull. Torr. Bot. Club, **20,** 431, pl. clxviii (1893). *Teinosolen grandiflora*, *T. macrosepala* et *T. pearcei* Hook. fil. ex Jackson in Index Kewensis, **2,** fasc. 4, 1041 (1895), *nomina.*

*Ample material lent by the Instituto Miguel Lillo has completely confirmed this supposition.

Comparison with the large genus *Bouvardia*, of North and Central America, shows that *Heterophyllaea*, as now constituted, is indeed closely related and has developed along analogous lines. In fact, the presence of pustules and the pentamery of the flowers seem to be the main distinguishing characters of *Heterophyllaea*, and it was reduced to *Bouvardia*, not without doubt, by Baillon, *Hist. Pl.* **7,** 461 (1880). It is an interesting fact that *Bouvardia* exhibits a wide range of characters in the habit, foliage and inflorescence of its many species. In particular, the inflorescence varies from a many-flowered thyrse to a single terminal flower. And there is one species, *B. erecta* (DC.) Standl., of Puebla in Mexico, which has an intricately branching habit with very reduced leaves and inflorescence, thus bearing a striking resemblance to *Heterophyllaea lycioides*. The existence of this range within the genus *Bouvardia* supports the reduction of *Teinosolen* and *Lecanosperma* to *Heterophyllaea*, but it would seem at present much too bold a step to unite *Heterophyllaea* with *Bouvardia*, if only because their areas of distribution are apparently separated by the Andes of Colombia, Ecuador and much of Peru. Besides, tetramerous flowers seem constant in *Bouvardia* and, in spite of Hooker's statements in his descriptions of *Teinosolen* and *Heterophyllaea*, no certainly tetramerous flower has been found in the material of either of these genera, while Rusby described the flowers of *Lecanosperma* as pentamerous. Again, the alternately placed one-flowered cymes—alternate pedicels, as Hooker called them, with alternate bracteoles—of the terminal inflorescence of *Heterophyllaea* distinguish the many-flowered species of this genus from *Bouvardia* (which has opposite and terminal 1–3-flowered dichasia), although far more evidence than is now available is needed for the explanation of this structure, which may be partly or wholly due to the suppression of lateral flowers of cymes.

As for the Brazilian genus *Hindsia*, which was merged in *Bouvardia* by Baillon (l.c.), it has pentamerous flowers and many other points of resemblance to *Heterophyllaea*, but the dehiscence of the capsule is septicidal (as in *Manettia*) with the loculi themselves splitting deeply into lobes, whereas the fruits of *Heterophyllaea* and *Bouvardia* dehisce loculicidally, with the valves in *Bouvardia* finally bifid. This point requires emphasis, since septicidal dehiscence was attributed to *Teinosolen* by Hooker, Baillon and Schumann, and to *Heterophyllaea* by Grisebach ; whereas loculicidal dehiscence was attributed to *Heterophyllaea* by Schumann and Baillon (the latter, by implication), and to *Lecanosperma* by Rusby. I have examined a capsule on the Pearce specimen (*Teinosolen pearcei*) of *Heterophyllaea lycioides*, and others on the type collection of *H. fiebrigii*, and I find the dehiscence to be exactly as described for *Lecanosperma* by Rusby : it was clearly loculicidal, but the septum had broken away early and disappeared so that the capsule appears unilocular. The valves do not become apically bilobed with age, but show a tendency to split from the base up the line of attachment of the septum. It is evident that Baillon and Schumann were simply repeating Hooker's incorrect description of the capsule of *Teinosolen*, and that they correctly understood the dehiscence of the fruit of *Heterophyllaea*.

The " pustules " of *Heterophyllaea* have been described by H. Solereder as peculiar internal glands, consisting of spherical groups of thin-walled cells, delimited from the remainder of the leaf-tissue by layers of cells

resembling an epithelium. They were said not to be bacterial nodules. Material from the type specimen of *H. pustulata* was examined by Solereder, who published his results in *Bull. Herb. Boiss.* **1,** 286 (1893) ; *Syst. Anat. Dicot.* 506 (1899), and Engl. trans. Boodle and Fritsch, **1,** 448 (1908) ; and, more elaborately, in a paper in *Sitzber. Physik-mediz. Soz. Erlangen,* **43,** 233–236 (1912). At my suggestion, Dr. C. R. Metcalfe has examined a leaf of *H. pustulata* from the Kew specimen of *Venturi* 8304. He reports that he is far from convinced that Solereder is correct in stating that bacteria are absent, and adds : " Working, as he did, solely with herbarium material, he cannot possibly have known for certain whether the particulate matter in the ' pustules ' are bacteria or not. In our slides I can see particulate material which might quite well be a mass of dead bacteria. On the other hand, it may be a purely chemical deposit, as Solereder maintains. The only way to obtain final proof would be to isolate the bacteria in cultures, grow the plants without any bacteria being present, inoculate them from the cultures, and see if pustules are formed as the result of the bacterial infection. This has already been done with various other members of the *Rubiaceae* in which there are pustules on the leaves ; for a summary of such work, see Boodle in *Kew Bull.* 1923, 346–348. Ordinary glands and glandular hairs are apparently absent from the *Rubiaceae.* The only exception of which I am aware is the presence of glandular shaggy hairs on the stipules, e.g. of *Isertia,* but these structures are quite unlike the pustules of *Heterophyllaea.* A careful microscopical examination of material preserved in formalin or acetic alcohol or, better still, of living specimens, would do much to settle this question."

Carmenocania porphyrantha *Wernham* in Journ. Bot. **50,** 241, t. 520 (1912) ; Standley in Field Mus. Publ., Bot. Ser. **7,** 44 (1930).

Wernham described this monotypic genus of *Rubiaceae* from material of a single collection, *Schlim* 755, from Carmen, in the province of Ocaña, Colombia. In the absence of fruit he was unable to determine the exact affinities of this showy plant, but he placed it provisionally in the tribe *Mussaendeae,* the genera of which have indehiscent fleshy fruits. In his " *Rubiaceae* of Colombia ", published in the work cited above, Standley retained *Carmenocania* without comment and keyed it off among the *Mussaendeae,* citing no further evidence. Unfortunately, both he and Wernham must have overlooked the fact that the type collection of this genus, *Schlim* 755, is also the type collection of *Howardia grandiflora* Wedd. in *Ann. Sci. Nat. Sér.* 4, **1,** 70 (1854), a species which Standley himself (*N. Amer. Fl.* **32,** 15, and loc. cit., 25) has reduced to **Pogonopus speciosus** (*Jacq.*) *Schum.* The genus *Pogonopus* is a member of the tribe *Condamineae* which is characterised, *inter alia,* by the dry capsular fruit. Examination of the available material of *Carmenocania* and *Pogonopus speciosus,* and comparison with Jacquin's description of his *Macrocnemum speciosum,* leave no doubt that Weddell's and Wernham's species are to be identified with *P. speciosus* in the wide sense as interpreted by Standley, other synonyms being *P. exsertus* (Oerst.) Oerst. of Costa Rica, and *P. ottonis* Klotzsch and *P. caracasanus* (Wedd.) Nichols. of Venezuela. That interpretation shows a species ranging from Costa Rica to Venezuela, and varying considerably in the indumentum of its leaves and corollas, the shape (from cuneate to cordate at the base) of the foliaceous calyx

lobe, and the shape and length (from shortly triangular-acuminate to quite long and linear-subulate) of the non-foliaceous lobes.

For the interest of future investigators the question may be raised whether these variable characters do not show some correlation in comparative isolation within the range of distribution of the species. At Kew, the Venezuelan material, which presumably represents the typical form, Jacquin's plant having been collected at Caracas, has the leaves glabrescent beneath, adpressed-pubescent along the veins; inflorescence, especially the pedicels, hypanthia and buds, densely pubescent, the hairs often somewhat spreading; normal calyx lobes shortly triangular to lanceolate-subulate, 1–2·5 mm. long; foliaceous lobe usually rounded or cuneate at the base, but the larger examples sometimes cordate; mature corolla densely pubescent, 2·7–2·8 cm. long. At the other extreme of the range, the material from Costa Rica and Panama, representing *P. exsertus*, is also fairly uniform, being characterised by leaves with a similar indumentum; by a much less conspicuously pubescent or glabrescent inflorescence; normal calyx lobes shortly triangular to subulate, 1–2 mm. long; foliaceous lobe very long-stalked, always cuneate at the base, somewhat shining and feebly pubescent to glabrous; corolla very shortly and less densely pubescent, often almost glabrescent and drying a blackish colour, often only 2·2 cm. long but sometimes up to 3 cm. Between the areas of these two groups are the specimens from Colombia, which can themselves be divided into two apparent entities. The first, representing *Howardia grandiflora* and *Carmenocania porphyrantha*, consists of two collections, *Schlim* 755 and *Kalbreyer* 927, both from the same locality, Carmen, in the province of Ocaña. The leaves are similar to those of the afore-mentioned groups; the inflorescence densely pubescent as in the Venezuelan material; normal calyx lobes long and lanceolate-subulate or subulate, 3–6 mm. long; foliaceous lobe always pubescent and conspicuously cordate at the base; corolla densely pubescent, 2·5–3 cm. long. The second Colombian group consists of two sheets from Santa Marta, *H. H. Smith* 100 and *M. T. Dawe* 698. It differs from the other groups by the leaves being very densely, velvety pubescent-pilose all over the lower surface. The other characteristics are a densely pubescent inflorescence; normal calyx lobes lanceolate-subulate or subulate, variable in length, commonly 1·5 mm. long; foliaceous lobe densely pubescent beneath, either cuneate or rounded-cordate at the base; and corolla very densely pubescent, up to 2·8 cm. long.

Hoffmannia megistophylla *Standl.* in Lloydia, **2,** 214 (1939), based on *A. C. Smith* 2930, proves on comparison to be **Patima guianensis** *Aubl.*, the interesting and unusual shrub which has been collected on several occasions in the interior of British Guiana, in the Potaro and Pakaraima region. Aublet described the leaves as glabrous, but they are minutely adpressed-pilose beneath on his specimen in Herb. Mus. Brit., as also in the more recent collections. I cannot believe that *P. formicaria* Johnst. in *Contr. Gray Herb.* **70,** 83 (1924) is distinct from the rest of the Guiana material which evidently hangs together as one species. For interesting notes on the myrmecophily of *P. formicaria*, see W. M. Wheeler in *Bull. Mus. Comparative Zoology at Harvard College*, **90,** no. 1, 91–92, pl. 13–14 (1942).

Malanea roraimensis *Wernham* in Journ. Bot. **50,** 243 (1912) ; Standley in Field Mus. Publ., Bot. Ser. **7,** 406 (1931) ; is a synonym of **M. obovata** *Hochr.* in Bull. New York Bot. Gard. **6,** 289 (1910), which was based on [*Robert*] *Schomburgk* 1002 [*Richard Schomburgk* 1729], from Roraima, the first of the two collections cited by Wernham, the other being *Schomburgk* 159 (299), which is in perfect agreement with it.

Ixora mazarunensis *Standley* in Bull. Torr. Bot. Club, **75,** 572 (1948) is **I. davisii** *Sandwith* in Kew Bull, 1937, 109. *Forest Dept.* no. 4815 is the type collection of *I. mazarunensis*. Another collection is *Forest Dept.* no. 4194, from 107 miles, Bartica-Potaro road, Nov. 12th, 1943 ; this was a tree 10 ft. high from Kakaralli-Clump Wallaba forest. The type of *I. davisii* was collected on the Upper Demerara River in 1935. As pointed out by the writer, this species is closely related to Aublet's *Patabea coccinea*.

Palicourea conferta (*Bth.*) *Sandwith*, comb. nov.—*Psychotria conferta* Bth., Bot. Voyage Sulphur, 107 (1844) ; Seemann, Bot. Voyage Herald, 137 (1852–7) ; Standley in Field Mus. Publ., Bot. Ser. **7,** 91 (1930).

Bentham's type specimen, collected by Sinclair on the Pacific coast of Colombia, is evidently a *Palicourea*, and his description is inaccurate since the tube of the sole surviving mature corolla is certainly not "brevissimus" and must have been longer than the mutilated limb. The material has probably not been studied since Seemann compared it with his gathering (no. 1015) from the Isla de Tumaco, on the Pacific coast of Colombia near the frontier with Ecuador. *Lehmann* 9017 and B.T. 755, from the rain forests of Timbiqui, in the same region, agree with Bentham's type and were identified by Standley (l.c. 140) with *Palicourea lugubris* Schum. et Krause in *Engl. Bot. Jahrb.* **40,** 337 (1908), the type of which was collected by *Lehmann* (no. 5652) in similar forests near Naranjal, on the coast of Ecuador. A short description of *P. lugubris*, with two further localities on the coast of Ecuador, was later given by Standley, l.c. 238 (1931). Allowing for some variability in the shape of the calyx lobes and the indumentum of the corolla tube, the Kew material of *Lehmann* 5652 agrees so well in facies and general characters with his no. 9017 and B.T. 755, and with the Sinclair and Seemann specimens, that I am led to the conclusion that *P. lugubris* is probably conspecific with and therefore a synonym of *P. conferta*.

Psychotria crocochlamys *Sandwith* in Kew Bull. 1939, p. 555, proves to be the earlier described **Cephaëlis tatei** *Standl.* in Bull. Torr. Bot. Club, **56,** 405 (1929), but if, as is likely, this species finally comes to rest in *Psychotria*, it will probably retain the epithet *crocochlamys*, owing to the existence of the binomial *Psychotria tatei* Standl. in Field Mus. Publ., Bot. Ser. **7,** 460 (1931) for a different plant.

Psychotria mazaruniensis *Standl.* in Bull. Torr. Bot. Club, **67,** 298 (1940) = **Cephaëlis jenmanii** *Wernham* in Journ. Bot. **52,** 313 (1914), but will perhaps retain the epithet *mazaruniensis* if kept in *Psychotria*, owing to the existence of the binomial *Psychotria jenmanii* Urb. Symb. Ant. **7,** 440 (1913) for a Jamaican species. See also below, in notes on *Cephaëlis kaieteurensis*.

Psychotria transiens *Wernham* in Journ. Bot. **52,** 314 (Dec. 1914)= **Cephaëlis ernesti** *Krause* in Notizbl. Bot. Gart. Berlin, **6,** 210 (May,

1914), of which it becomes a synonym, see below in notes on *Cephaëlis kaieteurensis*.

Cephaëlis kaieteurensis *Wernham* in Journ. Bot. **52,** 313 (1914).

The following collections agree excellently with Appun's type specimen from Kaieteur Falls in Herb. Mus. Brit. : Potaro River, Mahdia Creek at 108 miles on Bartica–Potaro road, fl. June 1942, *D. B. Fanshawe* in *Forest Dept.* no. 3480, fr. Jan. 1943, *id.* in *Forest Dept.* no. 3809 ; Potaro River, Pakatuk falls, Oct. 1898, *Jenman* 7408. Mr. Fanshawe notes that the species is a spreading shrub with whitish flowers and scarlet fruit, abundant in all types of forest at the Mahdia Creek. His no. 3480 came from Kakaralli-Clump Wallaba forest on lateritic ironstone soil.

As noted by Wernham, *C. kaieteurensis* is allied to his *C. jenmanii* which occurs in precisely the same region, on the Potaro River above the Kaieteur (*Jenman* 1291, *Sandwith* 1412), on the Membaru Trail, Pakaraima Range (*Altson* 381), and on the Kurupung Mts. near Macreba Falls (*Forest Dept.* no. 2778). The present writer finds the distinctions to be those of degree, although they are numerous and striking : *C. kaieteurensis* has more graceful, slender branchlets ; shorter stipules ; thinner, narrower leaves, with a remarkable caudate acumen usually 1·5–2·5 cm. long ; a more slender inflorescence with smaller heads, bracts and bracteoles ; all the floral parts shorter ; and smaller and rounder fruits. Otherwise, the two species share the facies and all the very distinctive main characters which separate them at once from all other Guiana species except *C. ernesti* Krause, of Roraima, which looks like a reduced, mountain relative of *C. jenmanii*. A synonym of *C. ernesti* is *Psychotria transiens* Wernham, of Roraima, which was published several months later in the same year, 1914 ; this has been proved by a comparison of the type collections of both species.

It seems likely that *C. kaieteurensis* is not more than a good variety of *C. jenmanii*, but, in the absence of evidence from intermediate specimens or field observations, it is wiser to treat it as at least a " young species." *C. umbellata* (R. et P.) Standl. (*C. conephoroides* Rusby), of Peru and Bolivia, is an obvious close ally of these plants, but has very short lobes in relation to the length of the conspicuous stipules, a violet inflorescence with the 3–5 heads arranged umbellately, not racemosely as in *C. jenmanii* and *C. kaieteurensis*, and a much longer and more conspicuous fruiting calyx.

Standley's retention of *C. umbellata* in *Cephaëlis* and his description of two new species as *Psychotria chondroloma* (according to him, related to *P. transiens*) and *P. mazaruniensis* (=*Cephaëlis jenmanii*, see note, above), taken together with Wernham's treatment of *C. jenmanii*, *C. kaieteurensis* and *P. transiens*, provide an instructive commentary on the position of this group of plants on the vague border-line between the two genera, *Cephaëlis* and *Psychotria*, as accepted by most botanists. Prof. Bremekamp, however, would certainly have rejected it from *Psychotria*, as understood by him in Pulle, *Fl. Surinam*, **4** (1934), since these species possess bracts and keeled boat-shaped bracteoles subtending the flowers within the involucres.

Cephaëlis aëtantha *Sandwith*, sp. nov. ; ob bractearum 4 involucri

laminas aequales elongatas angustas inferne in tubum inflatum ovoideo-subglobosum aequaliter connatas distinctissima.

Frutex 3 m. altus ; ramuli glabrati, summi aliquantum angulati pilis flavicantibus patentibus satis sparse induti, sub nodis dilatati. *Stipulae* e vagina brevi laxa atque lobis 2 lanceolato-subulatis 2–3·5 mm. longis medio ad 0·75 mm. latis pilis flavicantibus ascendentibus copiose indutis constantes. *Folia* oblongo-elliptica vel obovato-elliptica, apice conspicue cuspidato-acuminata acumine tenui saepius curvato acutissimo 1·3–2 cm. longo, basi in petiolum attenuata acute cuneata, 11–16 cm. longa, 4·3–6·3 cm. lata, tenuiter chartacea, utrinque pilis passim sed secus margines costam nervosque densius induta, pilis paginae inferioris brevioribus crispatis, pagina superiore nonnunquam glabrata sed costa semper conspicue pilosa, utrinque nitidula, costa nervisque primariis utroque latere 8–10 arcuato-ascendentibus supra planis subtus valde prominentibus flavis, secundariis subhorizontalibus parallelis his cum venulis laxe reticulatis utrinque praesertim subtus elevatis ; petiolus 1–2·3 cm. longus, supra applanato-canaliculatus, conspicue satis dense praesertim supra pilosus. *Inflorescentia* terminalis, solitaria ; pedunculus 3–6 mm. tantum longus, flavicanti-pilosus. *Involucrum* 6–7 cm. longum ; bracteae foliaceae coloratae 4, inferne in tubum viridem inflatum ovoideo-subglobosum 1·8–2·4 cm. diametro basi sparse pilosum ceterum glabrescentem flores primo involventem celantemque demum utroque latere fissum aequaliter connatae, laminis liberis rubris erectis vel ascendenti-erectis anguste lineari-ellipticis in apices acutos attenuatis 4–4·5 cm. longis 7–8·5 mm. latis chartaceis marginibus ciliatis necnon pagina exteriore pilosis intus glabris nervis principalibus 5 e basi erectis parallelis extra tantum prominulis. *Flores* complures, dense congesti ; bracteae bracteolaeque haud visae. *Calyx* totus 1·2–1·6 cm. longus, tubo cylindrico 3·5 mm. diametro extra subadpresse flavicanti-piloso intus glabro ; lobi triangulari-lanceolati, acuti, 2·2–2·5 mm. longi, extra dense pilosi. *Corolla* delapsa, haud visa. *Discus* conspicuus, medio constrictus, fere 2·5 mm. altus, 2·5 mm. latus. *Fructus* oblongo-ovoideus, satis sparse sed conspicue patule flavicanti-pilosus, fere 1·2 cm. longus, basin versus 8·5 mm. latus, siccitate laevis durus haud obvie sulcatus, calyce conspicue coronatus.

British Guiana. Eagle Mountain (watershed between Potaro and Konawaruk Rivers), Jan. 25th 1943, *D. B. Fanshawe* in *Forest Dept.* no. 3857 (type in Kew Herb.). " Shrub 10 ft. high, with lax spreading growth, from Kakaralli–Clump Wallaba (*Dicymbe*) forest on lateritic ironstone soil ; lvs. soft ; inflorescence terminal, solitary, ovoid, green, topped by 4 red membranous lobes."

This remarkable plant is unlike any species known to me on account of the narrow elongate limbs of the four equal involucral bracts which are equally connate below into a broad swollen ovoid-subglobose tube, enclosing the flowers and eventually split down each side. The outermost pair of involucral bracts of *C. guianensis* (Aubl.) Standl. have a limb similar in shape, though much shorter, but this species has a very short inner pair decussate with the outer (and apparently unconnected with the basal tube formed by that pair), and it is a glabrous plant with a white involucre, very different stipules, and a glabrous calyx only 0·3 mm. long. Relationship of Mr. Fanshawe's new plant with *C. potaroënsis* Sandwith, a

species endemic in the same region of British Guiana, may be indicated by the stipules, the papery leaves, and the large calyx and fruit.

It is unfortunate that only two involucres are available for examination, and that only in one of these have the flowers emerged from the split tube. At least six flowers were present in this involucre, but the corollas have all fallen and no smaller bracts or bracteoles have been seen.

The first part of the specific epithet, taken from the Greek ἀετός, eagle, was suggested by the coincidence of the peculiar wing-like involucral bracts with the name of the type locality.

Cephaëlis ostreophora *Wernham* in Journ. Bot. **55,** 284 (1917) ; Standley in Field Mus. Publ., Bot. Ser. **7,** 80 (1930).

This rather beautiful species has been known hitherto only from the unlocalised type specimen collected in Colombia by Triana, and now deposited in the Herbarium of the British Museum. The following recent collection was found to agree with Wernham's description and has been compared with the type : Colombia : Meta ; Villavicencio, alt. 1600 ft., March 1948, *C. Sandeman* 5816 : " Shrub growing in moist shade, infrequent ; leaves glossy ; flowers white, surrounded by hydrangea-blue bracts." The attractive blue and brown colouring of the bracts, described by Wernham, is well shown on both collections. The flower heads terminate young short shoots at the apex of branchlets, these young shoots being sometimes in pairs. The heads are therefore not axillary, as described by Standley, who has been led into error by Wernham's superficial comparison of the plant with *Cephaëlis evea* DC., a name based on *Evea guianensis* Aubl. This is a very distinct plant, now known as *Faramea guianensis* (Aubl.) Bremek., in which the flower heads terminate very short opposite lateral shoots consisting of a single internode, simulating short axillary peduncles.

Rudgea sandemanii *Sandwith*, sp. nov. ; *R. japurensi* Mart. ut videtur affinis, a qua ex descriptione calyce duplo majore apice profundius lobato praesertim corolla plus duplo breviore differt ; a *R. sessiliflora* Standl. inflorescentiis stipulis involucratis foliis longius acuminatis, a *R. cryptantha* Standl. foliis stipulis corollis multo minoribus statim distinguitur.

Frutex omnino glaber, ramulis teretibus internodiis summis brevibus plus minusve compresso-applanatis exceptis rhaphidibus albis minute punctatis ; stipulae albidae, semper laceratae deciduaeque reliquiis plerumque tantum obviis, tubulosae, 3–5 mm. longae, prope apicem setas aculeiformes subulato-conicas gerentes. *Folia* lanceolata vel ovato-lanceolata, apice longe (vulgo per 1·5 cm.) acuminata, basi cuneata, 6–9 cm. longa, 1·8–3·7 cm. lata, firme chartacea, siccitate supra olivacea opaca subtus pallidiora nitidula, costa utrinque prominente subtus domatiis conspicuis in axillis nervorum primariorum praedita scilicet membranis vulgo 2–3 mm. longis apice ore semicirculari vel circulari magnitudine variabili, nervis primariis utroque costae latere 6–8 ascendentibus atque longe a margine anastomosantibus, rete venularum supra obscuro subtus prominulo ; petiolus 3–4 mm. longus, supra canaliculatus atque superne marginatus. *Capitula* florum apice ramulorum solitaria, arcte sessilia, 6–10 mm. diametro, stipulis conspicue sustenta. *Flores* complures, circiter ad 8, sessiles, albi, suaveolentes ; bracteae bracteo-

laeque nullae. *Calyx* turbinato-cupularis, totus cum ovario 4–4·5 mm. longus, 3·2–3·5 mm. latus, nunc in 2–3 lobos 1·5–2 mm. longos apice breviter lobulatos irregulariter fissus, nunc in lobos 5 subaequales deltoideos 1–1·2 mm. longos atque latos divisus. *Corollae* tubus cylindricus, 5–5·5 mm. longus, 2 mm. latus, superne ampliatus, intus infra staminum insertionem dense papillosus, fauce haud barbata ; lobi oblongo-lanceolati, apice acuti incrassati cucullato-inflexi, 3–3·5 mm. longi, 1·5 mm. lati, limbus igitur circiter 6 mm. diametro. *Stamina* tubi apicem versus inserta, filamentis 2·5 mm. longis, antheris oblongis 1·75 mm. longis. *Stylus* totus 4–5 mm. longus, dimidio superiore pilosus ; stigmata 1 mm. longa. *Fructus* non visus.

Colombia. Meta : Villavicencio, in forest in moist shade, 1600 ft., Feb. 1948, *C. Sandeman* 5812 (type in Kew Herb.); shrub with scented white flowers and rather glossy, acuminate leaves.

The nearest relative of this species in Colombia is *R. retifolia* Standl., which has conspicuously pedunculate, exinvolucrate heads, smaller calyces and the corolla barbate in the throat. *R. sessiliflora* Standl., of Amazonian Peru, has very different, deeply lacerate stipules which fail to form an involucre round the flowers, and more shortly acuminate leaves.

Rhus bequaertii :—*Rhus bequaertii* Robyns et Lawalrée in Bull. Jard. Bot. Brux. **18,** 268 (1947). This species was described from a single gathering (*Bequaert* 4707) collected on the western side of Ruwenzori, 1400–1690 m. Investigation of Kew material shows that the shrub is more widespread than had been supposed, and that the following specimens, erroneously labelled *R. abyssinica* Hochst. ex Oliv. or *R. incana* Mill, should be referred here :

Uganda : Ruwenzori, 7000 ft., *Scott-Elliott* 7709 ; Agoro, Imatong Mountains, 5000 ft., *Eggeling* 804 ; Bugishu, 5000 ft., *Maitland* 1252 ; Toro, 6000 ft., *Snowden* 106 and *Maitland* 1290 ; Mt. Debasien, 6800 ft., *Eggeling* 2669 ; Sipi, Bugishu, *Thomas* 440 ; Mt. Elgon, 7000–8000 ft., *Dummer* 3622, also *Brasnett* 31, *Eggeling* 2442.

Kenya : Mt. Elgon 8000 ft., *Lugard* 256 ; West Kenya District, *Gardiner* 1328 ; Rumuruti District, 6–7000 ft., *Napier* 1268 ; Katimok Forest, Kamasia District, 7000–8000 ft., *Dale* 2413 ; Suam, NE Mt. Elgon, 6500 ft., *Dale* 3195 ; Embu, 4400 ft., *Graham* 1787 ; Subukia, *ca.* 6500 ft., *Albrechtsen*, Coryndon Mus. no. 6632 ; Western Kenya, 2200 m., *R. E.* & *T. C. E. Fries* 585.

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